

UNITED STATES PATENT APPLICATION

FOR

**A METHOD AND SYSTEM FOR A WIRELESS UNIVERSAL  
MOBILE PRODUCT INTERFACE**

Inventors:

Richard Neill Cameron  
Loic Jaouen Feinbier

Prepared by:

Morrison & Foerster  
425 Market Street  
San Francisco, California 94105-2482

# **A METHOD AND SYSTEM FOR A WIRELESS UNIVERSAL MOBILE PRODUCT INTERFACE**

## **CROSS-REFERENCE TO RELATED APPLICATIONS**

5           This application claims the benefit of U.S. Provisional Application No.  
60/199,488 filed April 25, 2000.

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## **TECHNICAL FIELD**

15           This invention relates to the field of wireless communications systems.  
More particularly, the present invention relates to the field of systems for enabling  
mobile electronic commerce including systems connecting product devices,  
micropayment systems and mobile devices, and specifically to a method and  
20           system for allowing a product or similar object to capture the services of a  
wireless mobile device within the wireless reach area of the product/object.

## **BACKGROUND ART**

25           A technical problem presently exists in the area of reverse-use for mobile  
phones and mobile devices as they are currently used. Today, products/objects  
have their own interface or man-machine-interface (MMI). For example, a soft  
drink or other type vending machine today has an MMI wherein the machine  
displays its wares, prices, provides input devices for a person to input the required  
payments in order to obtain a desired product. If one has no change or bills on  
30           hand of the proper type the purchase cannot be made from the machine.

          It is desirable to pay for the machines' offerings using one's mobile phone.  
It is further desirable that the vending machines' offerings and the price

information for the purchase would appear on one's mobile phone's display, so that all one had to do would be to type in his/her secret PIN code to authenticate a transaction to purchase an item. The vending device would accept a signal to dispense the desired item and a central payment provider would record the transaction, provide the necessary signal to the machine to provide the product and submit a bill to the mobile phone user at month end.

With the emerging popularity of the Internet as a purchasing tool, the demand for handling electronic payments in a secure and easy way has grown enormously. Credit cards and online account verification may yet well suit the handling of medium-priced and expensive goods, but are not economic enough for use with very low value purchases. This is why over the last few years a variety of solutions for these so-called *micropayments* have appeared to handle amounts as low as the fraction of a cent. However, there is a technical problem at present in the development of effective, concrete and efficient systems which integrate micropayment systems with product devices and related mobile personal devices.

Cellphones or mobile phones as they are also called (hereinafter "mobile device") have become ubiquitous, and initiatives such as Bluetooth™ are underway to embed tiny, inexpensive, short-range transceivers into the mobile devices that are available today, either directly or through an adapter device such as a PC Card. The radio operates on the globally-available unlicensed radio band, 2.45 GHz, and supports data speeds of up to 721 Kbps, as well as three voice channels. Bluetooth-enabled devices and adapters began to appear in 2000.

"Bluetooth" is a word used to refer to a technology, or to the Special Interest Group (SIG) formed in early 1998 by a group of computer and telecommunications industry leaders, including Intel™, IBM,™ Toshiba™, Ericsson™, and Nokia™. These companies together began developing a way for users to connect a wide range of mobile devices quickly and easily, without cables. To ensure that this technology is seamlessly implemented in a diverse range of devices, these leaders formed a special interest group to design a royalty-free, open specification technology, code named "Bluetooth." The SIG has quickly gained membership from companies such as 3COM/Palm™, Axis

Communication™, Compaq™, Dell™, Lucent Technologies UK Limited™, Motorola™, Qualcomm™, Xircom™ and is encouraging the involvement of all other companies interested in offering products taking advantage of a standardized, wireless means for connection. The specification for the Bluetooth technology is available on the SIG website at [www.bluetooth.com](http://www.bluetooth.com) and is hereby

The Bluetooth wireless technology is designed to revolutionize the personal connectivity market by providing freedom from wired connections. It is a specification for a small-form factor, low-cost radio solution providing links between mobile computers, mobile phones and other portable handheld devices, and connectivity to the internet. For example, at home, a phone functions as a portable phone (fixed line charge). When one is on the move, it functions as a mobile phone (cellular charge). And when the phone comes within range of another mobile phone with built-in Bluetooth wireless technology it functions as a walkie talkie (no telephony charge). It is envisioned that one can use their mobile computer to surf the Internet wherever they are, and have automatic synchronization of one's desktop, mobile computer, notebook (PC-PDA and PC-HPC) and the mobile phone. Early revisions of the specification has been released to members of the Bluetooth SIG. Version 1.0 was published Q2 1999. Version 2.0 are scheduled to be released in year 2001.

Additional efforts are underway to connect all types of devices to computer systems, and to make these devices callable by other systems users anywhere on the network. For example, Sun Microsystems JAVA™ and JINI™ technologies are aimed at embedding microprocessors in various devices which can, when connected to a network, provide information about the devices characteristics, how to communicate with it, etc. Bluetooth is a network transport protocol that could be used to allow attendee viewing devices to be connected to a JINI compatible system without being physically connected. JINI is described in more detail in the document titled "Jini(TM) Device Architecture Specification" which can be found at the Sun Microsystems web site

www.sun.com/jini/whitepapers/ and which is incorporated fully herein by reference.

Alternative embodiments can include other plug-and-participate devices such as those provided by other network technologies complimentary to Bluetooth and JINI, such as Hewlett Packard's™ JetSend™ technology which is another example of a service protocol that allows devices to intelligently negotiate information exchange.

Other technologies like Motorola's™ Piano, which can be built on top of Bluetooth, specifies what sort of information they exchange and how they communicate. It and other operating systems, like Symbian Ltd.s™ Epoc32 for mobile devices, can support Bluetooth and JINI technology.

While these and other similar technologies will provide the embedded means for various products and services devices to be enabled to communicate, wirelessly and otherwise, there are no present mechanisms for using the technologies to extend the products MMI from the device itself to unknown nearby wireless devices automatically.

These is a need in the art for a system and method for a product device or service operation to extend its man-machine-interface to such nearby unknown communications devices in order to simplify the means of transacting exchanges of goods and services in an extended arena. Similarly, a practical, concrete and useful system for handling micropayments using such wireless mechanisms is needed.

## SUMMARY OF THE INVENTION

The present invention provides a solution to the needs described above through a system and method for a wireless universal mobile product interface (WUMPI). Today, products/objects have their own interface, or man-machine-interface(MMI). Technically, the wireless universal mobile product interface of the present invention (WUMPI) innovates this space by replacing the product's MMI by implementing reverse software control via infrared and or Bluetooth or other wireless technologies (such as wireless LAN = IEEE 802.11b) to control the mobile device's screen – replacing the local software component on the mobile device which controls what is shown on the screen in terms of a man-machine-interface(MMI). This enables a product/object within the area of the mobile device to take over control via the infrared or other wireless capability of the mobile device and to “extend” the product interface to the mobile device that came within it's control range, or the product/object's personal area network (PAN). The infrared and or Bluetooth or other wireless technologies (such as wireless LAN = IEEE 802.11b) mentioned above will generally be referred to below as the “wireless transmission channel.”

A system is disclosed for providing reverse-control of a wireless mobile device in order to perform functions using the wireless mobile device for which it was not originally designed. A mechanism is disclosed for using a protocol to communicate via a wireless transmission channel port on a personal computer (PC) to the wireless transmission channel port of a mobile phone to take control of the mobile phone's menuing, interaction, display and other MMI capabilities to create an extended interactive product interface.

A method is disclosed for using a protocol to communicate via an wireless transmission channel port on a personal computer (PC) to the wireless transmission channel port of a mobile phone to take control of the mobile phone's menuing, interaction, display and other MMI capabilities to create an extended interactive product interface.

Similarly, a computer program stored on a computer readable medium or carrier wave is disclosed having computer code mechanisms for using a protocol to communicate via an wireless transmission channel port on a personal computer (PC) to the wireless transmission channel port of a mobile phone to take control of the mobile phone's menuing, interaction, display and other MMI capabilities to create an extended interactive product interface.

Additionally a system is disclosed for electronically connecting a user via a mobile device to a product device and to a micropayment system.

Still other embodiments of the present invention will become apparent to those skilled in the art from the following detailed description, wherein is shown and described only the embodiments of the invention by way of illustration of the best modes contemplated for carrying out the invention. As will be realized, the invention is capable of modification in various obvious aspects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

### BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the system and method of the present invention will be apparent from the following description in which:

**Figure 1** illustrates an exemplary Internet distributed system  
5 configuration.

**Figure 2** illustrates a representative general purpose computer configuration.

**Figure 3** illustrates a block diagram of an exemplary use of the present invention.

10 **Figure 4** illustrates a block diagram of an exemplary configuration of a system using the present invention.



## DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a solution to the needs described above through a system and method for a wireless universal mobile product interface (WUMPI). Today, products/objects have their own interface, or man-machine-interface(MMI). Technically, the wireless universal mobile product interface of the present invention (WUMPI) innovates this space by replacing the product's MMI by implementing reverse software control via wireless transmission channel and or Bluetooth wireless technologies to control the mobile device's screen – replacing the local software component on the mobile device which controls what is shown on the screen in terms of a man-machine-interface(MMI). This enables a product/object within the area of the mobile device to take over control via the wireless transmission channel or other wireless capability of the mobile device and to “extend” the product interface to the mobile device that came within it's control range, or the product/object's personal area network (PAN)

Other innovations in this space are product specific, and typically proprietary to that product of vendor or object, and must come with the product or be bought separately – often with the control logic for the MMI built into the control device (i.e. such as a remote control device for a stereo or TV). WUMPI's key feature of reverse-controlling the wireless mobile device and “collaborating” with the wireless mobile device's MMI capabilities as described above extend the product interface to any mobile device within the product/objects “personal area network”(PAN) and is unique to our knowledge today.

## OPERATING ENVIRONMENT

The environment in which the present invention is used encompasses the general computing and telecommunications environments, including wireless communications. A variant of the system operates on SMS over GSM in European environments and a second variant would operate over the Internet as the globally available communication medium.

Some of the elements of a typical Internet network configuration are shown in **Figure 1**, wherein a number of client machines **105** possibly in a branch office of an enterprise, are shown connected to a Gateway/hub/tunnel-server/etc. **106** which is itself connected to the internet **107** via some internet service provider (ISP) connection **108**. Also shown are other possible clients **101, 103** similarly connected to the internet **107** via an ISP connection **104**, with these units communicating to possibly a home office via an ISP connection **109** to a gateway/tunnel-server **110** which is connected **111** to various enterprise application servers **112, 113, 114** which could be connected through another hub/router **115** to various local clients **116, 117, 118**. Any of these servers **112, 113, 114** could function as a server controlling the communications and functions between a mobile device, a vendor/device, a payment function and a billing function of the present invention, as more fully described below. Any of these client machines could be a mobile device which has been captured by the present invention and could communicate wirelessly to another network device as required. In the preferred embodiment, as described more fully below, a message can be sent to a special email address or server for a receiver which is not known to the mobile device user..

An embodiment of the WUMPI System of the present invention can operate on a general purpose computer unit which may comprise some or all of the elements shown in **Figure 2** in the form of a laptop computer. The general purpose system **201** includes a motherboard **203** having thereon an input/output (“I/O”) section **205**, one or more central processing units (“CPU”) **207**, and a memory section **209** which may have a flash memory card **211** related to it. The I/O section **205** is connected to a keyboard **226**, other similar general purpose computer units **225, 215** which can include an wireless transmission channel (IR) port, a disk storage unit **223** and a CD-ROM drive unit **217**. The CD-ROM drive unit **217** can read a CD-ROM medium **219** which typically contains programs **221** and other data. Logic circuits or other components of these programmed computers will perform series of specifically identified operations dictated by computer programs as described more fully below.

The Mobile Service Link system of the preferred embodiment uses a vending machine equipped with an RS232 interface to connect to a PC. A laptop with wireless transmission channel adapter runs custom-written software to simulate a virtual vending machine and sends commands to the real physical one.

- 5 It transmits transactions to a Qpass™ Engine hosted at the vendor's service centre. A mobile phone with wireless transmission channel modem becomes the user interface for the vending machine. Using technology from Ericsson™, it receives and interprets the commands and displays a list of available beverages that the consumer can chose from. In this preferred embodiment, the consumer's
- 10 mobile phone becomes the user interface for the vending machine, by displaying the list of available drinks from which to select. A wireless transmission channel is used to enable direct communication of the mobile terminal with other objects like the vending machine. Thereby mobile telecom operator's networks are completely bypassed, reducing transaction costs and increasing speed. On the
- 15 back end the of the preferred embodiment a connection is made to the Qpass existing micropayment solution to handle payment and billing. The best mode as currently known is described in more detail below.

#### ADDITIONAL TECHNICAL BACKGROUND

- 20 The following additional background information on wireless and mobile positioning technologies such as *SIM Toolkit*, *Bluetooth*, *WAP* and *GSM positioning* is provided to aid in understanding the present invention which is used to combine in a unique and concrete and useful manner a micropayment system with a product device and a mobile wireless device, as well as to take control of a
- 25 nearby wireless device such as a cellphone.

Enabling technologies for mobile commerce encompass any kind of wireless technology from a handheld device, even including a supporting network.

- 30 However, communication infrastructure is not the only driver to make mCommerce work. A very important conceptual detail lies in the creation of secure, fast and easy-to-use payment mechanisms. Although there are many

existing concepts, most of these are limited to purchases via the Internet, or are restricted to purchases of digital goods only.

The preferred embodiment of the present invention will be better appreciated with an understanding of how these concepts could be applied to mobile commerce and physical goods purchases. An understanding of given micropayment solutions is critical to achieve this. There are at present as many as 20 major players in this field.

### **Technological Trends**

Some technologies such as the SIM Application Toolkit, smartcards and dual-slot phones have been known for a number of years. Other technologies such as the Wireless Application Protocol (WAP) or Bluetooth or Wireless LAN, etc. are emerging at a remarkable speed.

These are all technologies that enable the creation of applications to access value-added services and to conduct purchases from wireless devices. From an infrastructure perspective (handsets, networks), however, development is faster than ever.

Mobile phones are turned into Internet devices through the integration of WAP browsers. Personal Digital Assistants (PDAs) are going even further: where one previously needed an additional mobile phone to connect to the Internet, these PDAs now start to have this capability integrated into one device. Mobile phones, PDAs and other similar hand held devices are generally referred to hereafter as "mobile devices."

### **Evolution to 3<sup>rd</sup> Generation Wireless Networks**

#### ***Global System for Mobile Communication (GSM)***

GSM technology operates in 900MHz, 1800MHz and 1900MHz (US-specific) frequency bands and is the most common mobile standard in Europe and most of the Asia-Pacific region. This technology is used by more than 50% of the world's mobile phone subscribers.

#### ***High Speed Circuit Switched Data (HSCSD)***

HSCSD is a circuit-switched protocol based on GSM technology. It enables the transmission of data at up to four times the speed of the theoretical wireless transmission rate of 14.4 Kbit/s by using four radio channels simultaneously. A key limitation of this technology is a call set-up time of around 40 seconds.

#### ***General Packet Radio Service (GPRS)***

GPRS is a packet-switched wireless protocol that offers instant access to data networks. Theoretically, it will permit transmission speeds of up to 171 Kbit/s. GPRS provides an "always on" connection between the mobile terminal and the network by at the same time optimising the use of network capacity.

#### ***Enhanced Data Rates for Global Evolution (EDGE)***

EDGE is a higher bandwidth version of GPRS. EDGE will allow transmission speeds of up to 384 Kbit/s, which will make it possible to run mobile multimedia applications. It is an intermediary stage in the migration from GPRS to UMTS, as EDGE requires the modulation changes that will eventually be used by UMTS.

#### ***Universal Mobile Telephone System (UMTS)***

UMTS is a mobile phone system that will enable transmission speeds of up to 2 Mbit/s together with inherent IP support. This so-called 3<sup>rd</sup> Generation network standard will be able to process data 207 times faster than current GSM connections. The standard will finally enable high-quality extended mobile data applications, and with increased competition and improved technology, price points will come down.

*Evolution to 3<sup>rd</sup> Generation Wireless Networks (Source: Lehman Brothers)*

5           With the evolution of wireless networks into the so-called 3<sup>rd</sup> Generation Networks, it is expected that the limiting transmission speeds will soon disappear and open the way for wireless access to any multimedia source imaginable.

          Moreover, wireless connections to the Internet or Intranet will be permanent, with no need to dial up. Communications will work, and more  
10       importantly, be charged, per packet (starting with GPRS), thereby enabling completely new services at prices based on real usage.

          Smartcard technology as a means to conduct safe commerce is maturing. Prices have fallen significantly within the last few years, making smartcards a cheap throwaway article. At the same time, they have evolved from being a  
15       dumb, low-capacity storage medium to intelligent devices with up to 2Mb of

memory and support for popular programming platforms such as Windows™ and Java™.

### **Micropayments**

5 Credit cards and online account verification may yet well suit the handling of medium-priced and expensive goods for Internet purchases, but are not economic for use with very low value purchases. This is why over the last few years a variety of solutions for these so-called micropayments have appeared.

10 Digital goods such as music, videos, information services, news, electronic books, online games and adult content can now be sold in a profitable way. The same applies for pay-per-use services, online product support or even access to a web site itself. Similar concepts existed with French *Minitel*™ and German *BTX*™ online services.

In the meantime, systems exist that claim to handle amounts as low as the fraction of a cent. However, these models are not yet shown to be realistic.

## Micropayment Strategies

Before we go into further detail about micropayment models, it is useful to have a general view of existing digital money schemes.

Model	Peer2Peer	Economy	Security	Anonymity
Transactional – A network, such as the Internet, is used to create a debit or credit to a traditional deposit account or credit card. In these schemes, no new money is created. The physical equivalent would be a check or credit card charge slip.	✓			
Token – New money is created and held in the form of electronic entities (often called coins or tokens). Each entity has a specific value. When purchased, a unique identification number is issued as part of the entity. When turned in, this identification number is checked centrally in order to prevent entities from being reused. The entities may be stored on a local PC or on smartcards. The physical equivalent to this model is cash and Eurocheques or Travellers Checks.	✓	✓	✓	
Nominal – New money is created and stored in an electronic (bank) account, which may be decreased as payments are made. The account can be “recharged” by transferring money from traditional accounts. The physical equivalent to this model is a chequebook.	✓	✓	✓	✓

5

## Digital Money Schemes

Among the different micropayment solutions available on the market today, most can be reduced to a very basic set of different concepts. In general up to four different parties are involved in a micropayment transaction:

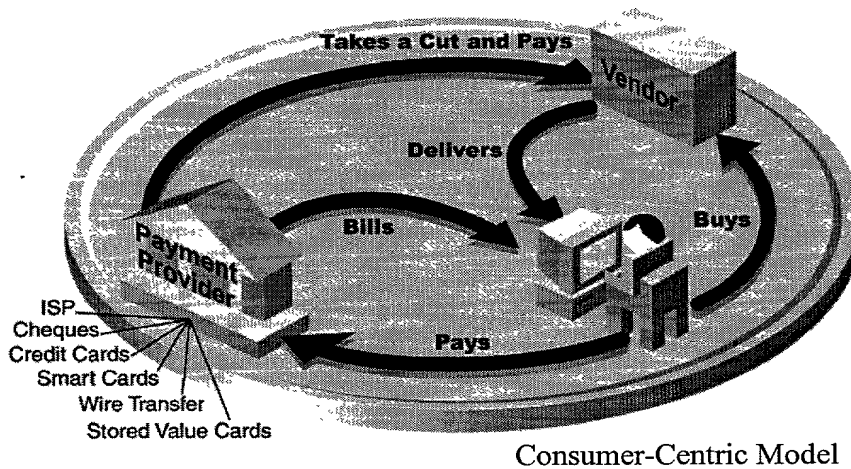
- 10 The consumer or buyer of digital and/or physical goods.
- The vendor, either a content provider (if selling digital goods) or a merchant (if selling physical goods), or a combination of both.
- The payment provider, either the technology provider and/or a bank, a credit card organisation or system of those financial institutions, an ISP or a

telecommunications company, providing and/or hosting the micropayment solution. ( The terms payment provider and bank will be used as equivalents and may comprise a whole system of financial institutions that is not further detailed.)

Possible combinations of these players can be examined as a source of  
5 revenue, resulting in three different models:

### Consumer Centric Model

In the consumer centric model, the payment provider derives a significant  
portion of its revenues from the end-consumer. In addition the payment provider  
10 usually outsources the billing process on behalf of the vendor, from which  
additional royalties are claimed for this service. Major players in this model are  
Magex™, BiBit™ and Millicent™.

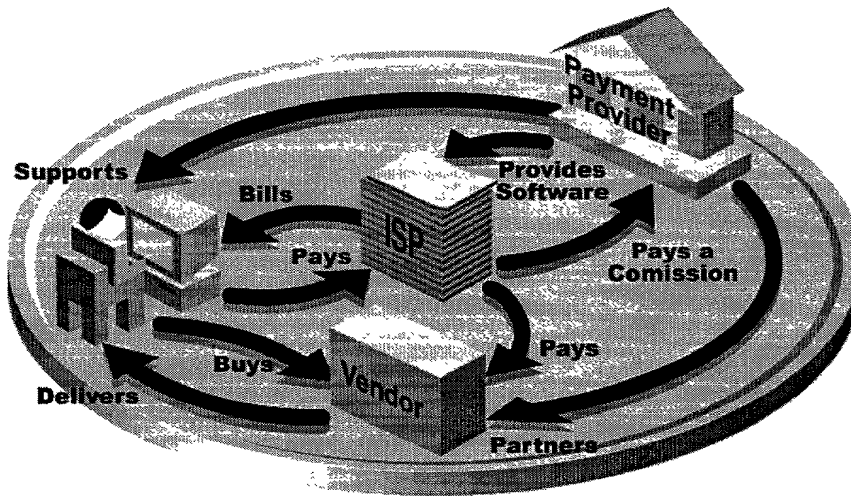


15



### ISP-Centric Model

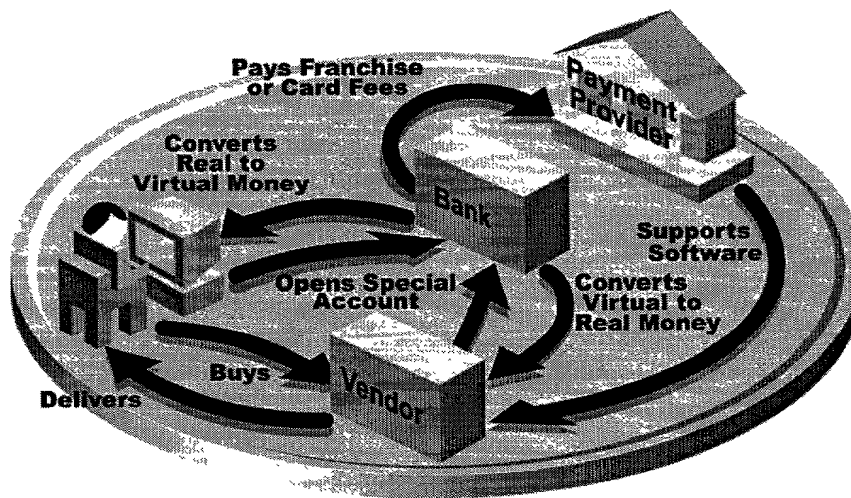
- The ISP-centric model leverages existing investments in billing systems and Internet infrastructures (for consumer authentication). It thereby generates new revenue sources for ISPs. Usually, payment providers either sell the
- 5 necessary technology to the ISPs and/or receive royalties from them. Players in this field include iPIN™, Clickshare™, NetToll™ and NTSys™.



ISP Centric Model

### Bank Centric Model

Within the bank-centric model, technology is franchised by financial institutions from the payment providers. The latter usually receive franchising and transaction fees. Good reputation and trust in those financial institutions, as well as an existing security infrastructure are critical advantages of this model. The dominant player in this field is Mondex™.



Bank-Centric Model

All micropayment solutions can be reduced to essentially two different paradigms:

#### *"The Deferred Aggregator"*

The "deferred aggregator" summarises all those micropayment solutions where small purchases are summed up until the end of a cycle ("deferred") and then billed to the consumer's account or credit card. In most cases, vendors would receive payment at the end of the agreed cycle directly by the mediating party.

Sometimes consumer bank accounts would be debited immediately, but vendors would still be paid with a delay, giving the mediating party the opportunity to take an additional cut (apart from transaction fees) by using this money.

Among the players using this dominant micropayment model are *Clickshare™*, *eCharge™*, *ehpt™*, *InterCoin™*, *iPIN™*, *KLELine™*, *Magex™*, *IBM™*, *NetChex™*, *NetToll™*, *Qpass™* and *TrivNet™*.

## 5                                    **"Prepaid Digital Cash"**

This model is relevant for several different types of accounts, from simple, prepaid consumer accounts, held at the payment provider, to virtual bank accounts with electronic money, hosted by a bank or other trusted financial institution. When a purchase is made, the price is deducted real-time from the consumer's  
10 digital account. Payment providers make their money through transaction fees and by using any temporary monetary "overcapacities" for investments.

Some of the players that use this model are *CyberCash™*, *DigiCash™*, *Millicent™*, *NetBill™*, *OneClickCharge™* and *SmartAxis™*.

## **Existing Solutions**

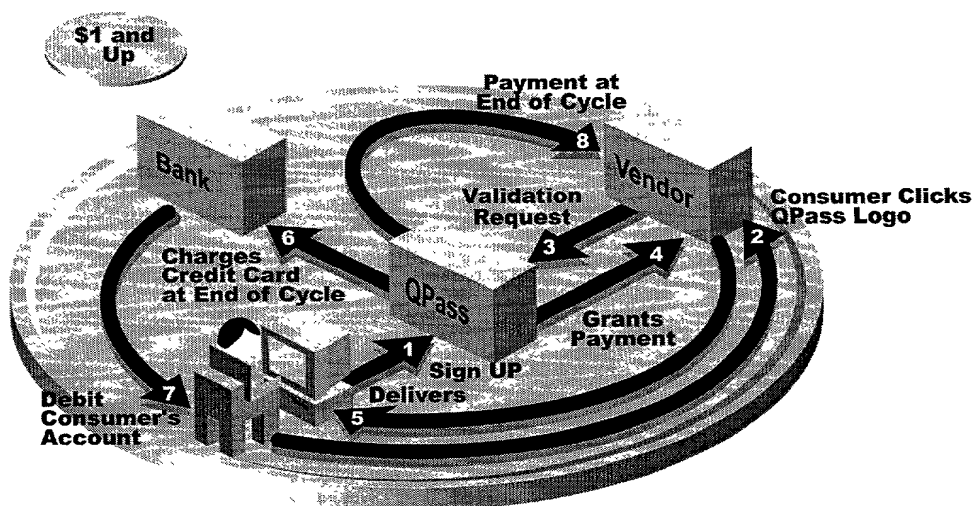
15                    Today there is an almost overwhelming number of different and non-different micropayment solutions, some of which have proven successful in a particular niche, others that have not.

The micropayment system provider of interest in the preferred embodiment is *Qpass™*([www.Qpass.com](http://www.Qpass.com)).

*Qpass* was founded in June 1997 and first launched its service in March 1999. Among *Qpass'* content partners are *The Wall Street Journal™*, *The New*  
20 *York Times™*, *Corbis™* and others. Strategic partners comprise *Accenture™*, *Trivnet™*, *Netcentives™* and more.

Through its system, *Qpass* claims to be able to handle transactions with values as low as \$1 and up. Purchases are aggregated by *Qpass* and charged to the consumer's credit card at the end of the month (see the *Qpass Business Model*  
25 figure below). *Qpass* recently partnered with *Trivnet* in order to provide consumer billing through telcos, ISPs and others.

Support for different currencies is planned for the next release. Vendors are paid by *Qpass* directly.



*Qpass Business Model*

5 No additional hard- or software is required for the consumer. For vendors, Qpass provides and installs necessary software enhancements and trains vendor personnel. The service is free for consumers. Vendors pay Qpass an initial installation fee depending on effort and subsequently a share of the sales on a pro-rata basis.

10 Transaction security is granted through conventional ID and password technique and Secure Socket Layer (SSL) encryption. All consumer data is kept by Qpass unless the user allows forwarding of data to vendors.

Besides easy handling of payments, Qpass provides consumers with a set of administrative functions on its web site to centrally maintain electronic bills (including product passwords and serial numbers received) for purchases from a Qpass-enabled vendor. Additional technical details on the Qpass Transaction Processing Solution can be obtained from their web site at [www.Qpass.com](http://www.Qpass.com) which is hereby incorporated fully herein.

20 While the Qpass system is used in the preferred embodiment of the present invention, there appear to exist many other possible solutions to the micropayment problem. All of the known solutions miss one aspect, however, the independence

of a storage medium. To make payments more convenient, an electronic cash solution should enable the user to keep capital on all sorts of media, such as PCs, PDAs, smartcards and on accounts in the network (telco, bank, payment provider). Additionally, it should be easy to transfer funds between different parties, for example via e-mail or even using the file transfer protocol (ftp). The preferred embodiment of the present invention as described in more detail below, provides a system and mechanism for such transfers.

### **Smartcards**

Smartcards are credit card-sized plastic cards with an integrated memory and microprocessor chip. The use of smartcards ranges from the simple storing of personal and/or valuable information to holding and running complete software applications.

SIM-cards (Subscriber Identification Module) are a special variant of smartcards, used in European GSM phones. SIM cards are able to execute applications on the mobile handset and can even modify its menu structure. Applications can either be written using a proprietary platform, provided by the card manufacturer, or according to the SIM Application Toolkit specification (part of the GSM standard). The latter will run on almost all mobile phones, manufactured after 1998. This section gives a GSM-specific overview of what kind of applications are possible with smartcards. It therefore concentrates on the description of the SIM Application Toolkit and what development tools are available. Another focus is set on mobile smartcard readers (dual-slot mobile phones) and how these enable eCommerce. Additionally, different approaches to provide prepaid solutions, using smartcards, are described below.

### **SIM Application Toolkit**

SIM Application Toolkit ("SIM Toolkit" or, "STK") is an ETSI (European Telecommunications Standard Institute) standard for Value Added Services (VAS) and eCommerce over GSM mobile phones.

In 1995, the first ideas and draft documents were specified as a result of some network operator's desire to offer service differentiation without the need for mobile manufacturers having to build different models or variants of their mobile phones. The concept was then incorporated into the GSM standard as part 11.14, later in 1996.

Besides the ability to enhance and change a mobile's menu system, SIM Toolkit allows the flexibility to update the SIM with new services directly downloaded. Moreover, network operators can remotely provision the user's wireless terminal, simply by sending specific codes embedded in SMS messages from the server.

SIM Toolkit applications are generally updated and communicate through SMS messages, but may in the near future move to another means of transport such as Unstructured Supplementary Services Data strings (USDD) or General Packet Radio Service (GPRS).

The features of the SIM Toolkit can be classified into five different categories:

- Man-Machine Interface (getting user input, playing sound)

- Communication Services (sending SMSs, setting up calls)

- Menu Management & Application Control (menu structure)

- Accessory Management (Dual Slot phone commands)

- Miscellaneous (SIM card settings)

Compared to the Wireless Application Protocol (WAP), the SIM Toolkit is more mature since it is at a later stage in development. In general, SIM Toolkit is seen rather as complementary than competitive to WAP, or at least as a step towards WAP.

## Major Players

Since its first release, the SIM Application Toolkit specification has been taken up in several major manufacturers' phone ranges and is supported by a variety of new and established network operators. These operators have even stipulated that all new phones supplied on their network must support the SIM Application Toolkit.

## Handset Manufacturers

As of October 1998, the major handset manufacturers have, or have committed to SIM Toolkit compatible handsets (including NEC™, Sagem™, Ericsson™, Philips™, Nokia™, Sony™, Panasonic™, Motorola™, Siemens™, Alcatel™, Mitsubishi™ and Bosch™).

SIM Toolkit commands have been grouped into classes for handsets to support (classes apply to handsets, not to SIM cards). Up to date there are three classes, as detailed in Table 1.

SIM Application Toolkit Command	Class 1	Class 2	Class 3
Call Control		✓	✓
Cell Broadcast Download		✓	✓
Display Text		✓	✓
Event Download			✓
Get Inkey		✓	✓
Get Input		✓	✓
Get Reader Status			✓
Menu Selection		✓	✓
MO Short Message Control			✓
More Time		✓	✓
Perform Card APDU			✓
Play Tone		✓	✓
Polling Off		✓	✓
Poll Interval		✓	✓
Power On Card			✓
Power Off Card			✓
Provide Local Information		✓	✓
Refresh	✓	✓	✓
Select Item		✓	✓
Send Short Message		✓	✓
Send SS		✓	✓
Send USSD			✓
Set-up Call		✓	✓
Set-up Event List			✓
Set-up Menu		✓	✓
SMS-PP Download	✓	✓	✓
Timer Management / Timer Expiration			✓

Table 1: SIM Application Toolkit Classes (Source: ETSI, GSM 11.14)

- 5 Support of SIM Application Toolkit is optional for handsets. However, a handset claiming to support all SIM Toolkit functions, does not necessarily need to support them all, but at least all functions within a class (see Table 1). An overview of current handsets that support SIM Application Toolkit is given in Table 2.



Manufacturer	Model(s)	Class 1	Class 2	Class 3
Alcatel	One Touch Easy	√	√ <sup>1</sup>	
Alcatel	One Touch Club / Club +	√	√ <sup>1</sup>	
Alcatel	One Touch Max	√	√ <sup>1</sup>	
Alcatel	One Touch Pocket	√	√ <sup>1</sup>	
Alcatel	One Touch Easy Dual Band	√	√ <sup>2</sup>	
Alcatel	One Touch View Dual Band	√	√	
Bosch	GSM 509 / 509 Dual	√	√	
Bosch	World 718	√		
Bosch	Dual-Com 738	√		
Bosch	GSM 908	√		
Bosch	GSM 909 Dual / Dual S	√	√	
Ericsson	T28s / T28 World	√	√	
Ericsson	T18s	√	√	
Ericsson	T10s	√	√	
Ericsson	A1018s	√	√	
Mitsubishi	Trium Galaxy	√	√	
Mitsubishi	Trium Astral	√	√	
Mitsubishi	Trium Geo	√	√	
Mitsubishi	Trium Aria	√	√	
Mitsubishi	Trium Cosmo	√	√	
Motorola	Timeport L7089	√	√	√
Motorola	v3688	√	√	
Motorola	Star TAC 130	√	√	
Motorola	CD92x	√	√	
Motorola	CD93x	√	√	
Motorola	L2000	√	√	
Motorola	L7089	√	√	
Motorola	P7389	√	√	
Motorola	M30	√	√	
NEC	DB500	√	√ <sup>3</sup>	√ <sup>3</sup>
NEC	DB2000	√	√ <sup>3</sup>	√ <sup>3</sup>
NEC	DB4000	√	√ <sup>3</sup>	√ <sup>3</sup>
Nokia	3210	√	√	
Nokia	5190 <sup>4</sup>	√	√	
Nokia	6150	√	√	
Nokia	6190 <sup>4</sup>	√	√	

<sup>1</sup> With firmware version 3.0 or higher.

<sup>2</sup> With firmware version 14.0 or higher.

<sup>3</sup> Only partially.

<sup>4</sup> GSM1900 phone.

Nokia	7110	✓	✓
Nokia	7190 <sup>5</sup>	✓	✓
Nokia	8210	✓	✓
Nokia	8850	✓	✓
Panasonic	GD90	✓	✓
Panasonic	GD70	✓	✓
Panasonic	GD50	✓	✓
Panasonic	GD30	✓	✓
Philips	Savy / Savy DB	✓	✓
Philips	Genie / Genie DB	✓	✓
Philips	Xenium	✓	✓
Sagem	GPRS	✓	✓
Samsung	SGH-800	✓	✓
Samsung	SGH 2100	✓	✓
Samsung	SGH 2200	✓	✓
Siemens	S25	✓	✓
Siemens	S2588	✓	✓
Siemens	C25	✓	✓
Siemens	SL10	✓	✓
Siemens	S10 / S10 active	✓	✓
Siemens	S11	✓	✓
Siemens	C10 / C10D	✓	✓
Siemens	C11	✓	✓
Sony	CI	✓	✓

Table 2: SIM Application Toolkit compatible handsets

## Network Operators

5 Since the introduction of the standard SIM Toolkit, it has been supported by Dutchtone™ (Netherlands), Orange™ (UK), D1 T-Mobil™ and VIAG™ Interkom (Germany), Telecom Italia™ Mobile (Italy), KPN Orange™ (Belgium) and many more.

10 A variety of SIM Toolkit powered value-added services exist in production today.

### Development Tools and Products

Today, almost all of the SIM card manufacturers offer application development suites to develop programs according to the *SIM Application Toolkit*

<sup>5</sup> Only partially.

(GSM 11.14) standard. However, those environments differ in capabilities such as Java and multi-platform (multi-SIM) support.

In order to resolve those issues, a group of major players (GEMPLUS<sup>TM</sup>, Giesecke & Devrient<sup>TM</sup>, ORGA<sup>TM</sup> and Schlumberger<sup>TM</sup>) has recently formed the  
5 *SIM Alliance*. *Microsoft*<sup>TM</sup> is also getting into co-operations to promote *Visual Basic*<sup>TM</sup> and *Windows for Smartcards*<sup>TM</sup> in order to get a stake in this market.

**Dual-Slot Phones**



*Motorola Start TAC Dual-Slot (Source: BT Cellnet)*

- 10 Dual slot phones are mobile phones with an integrated smartcard reader. They allow the extension of smartcard-based payment concepts to the wireless terminal. Any smartcard, be it a credit or banking card or a prepaid public phone card, could be used to conduct payments directly from a mobile phone, thereby turning it into a mobile payment terminal.
- 15 Taking the example of prepaid cards, dual-slot mobile phones could enable these to suddenly become a much broader means of payment. Not only could they be used to make phone calls in public phones but also to pay for mobile calls or even goods and services.

Manufacturer	Model(s)
Alcatel	One Touch Pocket <sup>6</sup>
Motorola	StarTac D
Motorola	Timeport L7089 <sup>7</sup>
Sagem	MC 840 M

*Table 3: Dual-Slot Mobile Phones*

<sup>6</sup> Alcatel has developed a working prototype that was announced but finally never released. A new version has again be announced for the fourth quarter of 2000.  
<sup>7</sup> Not yet launched.

Some major advantages are immediately visible:

Replacement cards can be purchased literally everywhere, the distribution infrastructure is already in place;

5           Prepaid cards are widely accepted, they are handy and help people keep track of their spending;

No time-consuming and expensive online credit limit verification is needed, transactions are cheap and fast;

Just like cash, payments are anonymous.

10           However, only the future will show if these advantages are sufficient for the success of dual-slot mobile phones. Although some major manufacturers such as Motorola, Alcatel and Sagem have developed handsets (see Table 3), so far no real public rollout has been achieved.

### **Prepaid Solutions**

15           Prepaid systems can be used today to pay for all kind of services and goods. There are different technical paradigms and ways to recharge prepaid accounts.

### **Technical Paradigms for Pre-paid Solutions**

20           Three different technical paradigms can generally be distinguished for prepaid solutions:

### **Handset Based Solutions**

25           This solution is used to handle prepaid cellular phone accounts only. In this case the handset itself contains software and a chip that stores the pre-paid airtime. The restrictions of this model are obviously that it requires a special handset, which at the same time binds the subscriber to a specific operator. Given the advent of SIM cards and the costs that occur due to the customised production of handsets, this solution is likely to disappear.

### **Card Based Solutions**

In a card-based system the prepaid value is stored on the chip of a smartcard. In addition, this solution requires a GSM Phase 2 compliant phone. Thanks to the so-called Advice of Charge (AoC) and SIM Application Toolkit  
5 functionality, the prepaid account can be recharged over the air (usually via SMS). Applications of card-based prepaid solutions reach further than only the handling of cellular phone accounts. Being a sort of digital currency, where the money is directly taken from the card, payments for all kinds of goods and services may be conducted. With the maturation of smartcard technology and given its ease of  
10 use, this solution is likely to become dominant in the near future.

### **Network Based Solutions**

In a network-based system the value of the prepaid account is stored somewhere on a server hosted by the network operator. When the account is  
15 recharged, then the purchased value is simply added to the current amount, stored on the server. This is by far the most applied solution today. Again, it is mainly applied to handle prepaid cellular phone accounts, however, one could also imagine to pay for goods using such accounts.

### **Recharging of Prepaid Accounts**

20 A variety of different concepts exist to recharge prepaid accounts, some of which apply to public or cellular phone systems only. Others may be used to recharge prepaid accounts for any kind of payments such as for cantina lunches or to buy beverages from vending machines.

### **Replacing the Card**

25 The most common, and simplest, solution for “recharging” a prepaid account is to actually buy a new pre-charged card. Production of smartcards has become so mature that cost is no longer an issue.

### **Automatic Recharging**

In this solution the subscriber's prepaid account is automatically re-charged in chunks of the agreed value, once the subscriber's account goes under a predefined threshold, the amount is usually either directly debited from the bank, or charged to the consumer's credit card.

### **Recharging by Call**

In this case, the subscriber has to actually call a phone operator or service provider to re-charge the account. Again, payment may be deducted from the bank, or charged to a credit card. In countries such as Italy, consumers can also buy specific scratch cards. These contain a secret number to be communicated to an automatic response application under a predefined phone number. In Italy, it is also possible to recharge your prepaid account at ATMs. The consumer simply has to enter their phone number and PIN code and the amount is then automatically deducted from their bank account, and the bank reports the new prepaid balance to the network operator.

### **Recharging by SMS**

Similar to the recharging by call, in this case the subscriber has to send a short message (SMS) to the network operator, who in return, will refill the account. Payment is conducted in the way that was agreed upon the consumer's subscription.

### **Recharging using Public Phone Infrastructure**

Some cellular phone operators such as French *Itineris*<sup>TM</sup> allow their subscribers to recharge their accounts using the existing public phone infrastructure. Since most of the public phones today are equipped with smartcard readers anyway, a subscriber can simply walk into a phone booth, dial a special number and code and insert his banking or credit card. The selected amount is

then added to his prepaid account on the network or over the air to his SIM card.

### **Dual Slot Phones**

- 5 A new kind of handsets, equipped with an integrated smartcard reader, enables this way of account recharging. To do so, the subscriber would, for example, use a SIM Toolkit application provided by the network operator to select the amount. Subsequently, the subscriber would pay by simply inserting his credit card into the phone's second slot and punching in the PIN code.

### **Applications for Prepaid Systems**

- 10 A large variety of different applications are offered today when using prepaid solutions:

#### **Public and Mobile Phones**

- 15 For public and mobile phones, simple throwaway memory cards are sold with a preloaded value to be deducted with each call. This is the most common application for prepaid card systems and it is available in almost any European country.

#### **Vending Machines**

- 20 Companies often provide prepaid cards to their employees to be used with vending and coffee machines.

- 25 *CANTV*<sup>TM</sup>, the largest telecommunications provider in Venezuela, goes even beyond this and has recently introduced a program that allows owners of prepaid phone cards to use these for other purposes, such as buying beverages at vending machines. Given the huge investment that telecoms. have put into smartcard infrastructure, these kinds of concepts are likely to be copied by other major players.

## **Public Transport and Parking**

In Switzerland, precisely in Geneva and Lausanne, prepaid smart cards are used to pay for public transportation such as busses. People can thereby avoid the need to carry change all the time for payments.

- 5           US-based *POM™ Inc.* manufactures parking meters that are able to read and deduct parking fees from prepaid smartcards. The advantage of this system is that it is fairer, since it allows payment on a per minute basis, whereas traditional systems usually charge in blocks of 15 minutes.

## **Internet Access and Purchasing**

Philippines' *WEBSCAPE™* introduced a prepaid Internet access card in 1997. This card provides users prepaid Internet access for a limited amount of time, thereby helping them to keep track of their spending. Moreover, there is massive use of prepaid solutions for purchasing goods on the Internet.

## **Wireless Application Protocol (WAP)**

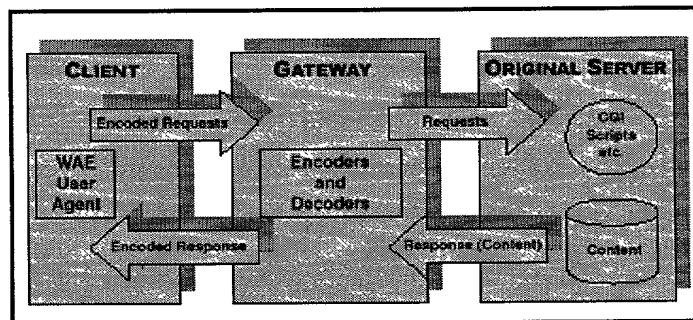
The Wireless Application Protocol (WAP) was designed to bring Internet content and data services to mobile phones and other wireless terminals.

- 20           To achieve this, WAP uses the Wireless Mark-up Language (WML), that is optimised for wireless handheld mobile terminals. WML is a stripped down version of HTML. The WML language is specifically designed to meet the needs of wireless devices.

- 25           Initially WAP was created by a group of companies such as telecom manufacturers (Nokia™, Ericsson™, Motorola™), network operators (Sonera™, Telia™, AT&T™, DT™, France Telecom™) and software and service companies (IBM™, RSA™, Unwired Planet™, Symbian™). The WAP Forum was founded to ensure the global success of the standard and keep it independent. The technology has been designed to accommodate most of the wireless transmission standards such as CDPD, CDMA, GSM, PDC, PHS, TDMA, TETRA and DECT.



Its architecture corresponds with the International Standard's (ISO's) 7-layer OSI model.



WAP Architecture (source: [www.wapforum.org](http://www.wapforum.org))

5

WAP also specifies a proxy server (usually hosted by the network provider) that acts as a gateway between the wireless network and the wireline Internet, providing protocol translation. To optimise the data transfer for the limited transmission speeds of today's wireless networks, the gateway translates WAP pages into so-called bytecode.

10

Still WAP is rather new, with only a few terminal devices available today. Within the next 3-4 years, however, WAP devices are expected to globally outnumber personal computers as the major access device for Internet services.

15

Among the list of devices, available today, are recent handsets from Nokia™ (6150 and 7110), Ericsson™ (E320 and R380), Siemens™ (S25), Mitsubishi™ (T250) and Samsung™ (SGH-810). Apart from handsets, a variety of WAP servers, gateways and microbrowsers for PDAs are available.

### WAP Identity Module (WIM)

20

The current WAP version 1.1 provides no security features that are vital for applications such as online banking and purchasing. This is why the WAP Forum has created the WAP Identity Module (WIM) specification.

WIM is a mechanism that can be implemented as an application running on a smartcard or be placed on a tamper resistant device such as a mobile phone.

WIM is intended to provide the same level of security for mobile commerce applications that currently can only be achieved through SIM Toolkit.

The WIM will address two fundamental security issues. The first one is securing the wireless transport layer (WTLS) between the WAP gateway server and the mobile client terminal. This can be considered the same kind of functionality as the Secure Socket Layer (SSL) used on the Internet today. WIM will ensure mutual authentication and confidentiality using cryptography algorithms that are stored on the smartcard or device.

The second part of the security function is to secure the application layer through the use of digital certificates and other non-repudiation techniques. WIM will therefore be using public key and RSA™ encryption technology.

The WIM module is designed in a way that it can either run as a stand-alone or together with other applications running on the same smartcard or device. In particular, a smartcard hosting the WIM module does not necessarily need to be a SIM card. For example, the WIM module could just as well reside on a banking card, in order to allow secure mobile payments with a dual-slot phone. WIM functionality is accessible to WAP applications (using WML script) as well as to standard smartcard applications.

Given the importance of WIM for future mobile commerce applications, a number of major smartcard manufacturers are currently developing such cards. Among these new products is the *ConnectIC™* SIM card by *Oberthur Card Systems™* and the *Simera e-motion™* by *Schlumberger™* (using PKI technology from *Entrust™*). Both cards will support Java™ and be compliant with the WAP 1.2 WIM specification.

## **WAP vs. SIM Application Toolkit**

Although WAP is network-based, whereas SIM Toolkit is running on the SIM card inside the handset, both technologies provide a variety of similar functions. Both allow a dynamic user interface to be displayed on the handset and to be automatically updated over the air. However, awaiting the arrival of WIM, WAP does not yet provide security features in the same way as the SIM Toolkit.

Given the advanced maturity of the SIM Application Toolkit (especially of the push-mechanism and for security support) at this stage, both technologies must be considered complementary rather than in direct competition.

Stockholm-based company *Across Wireless*<sup>TM</sup> ( [www.acrosswireless.com](http://www.acrosswireless.com))  
5 is providing a WAP browser based on SIM Application Toolkit. This software will enable the majority of today's mobile phones to access WAP pages.

However, due to WAP's more dynamic nature and the fact that applications, located on the subscriber's SIM card, are necessarily very 'thin', the balance is likely to change in the future in favour of WAP, as the technology is  
10 evolving. WAP is also more flexible in the sense that it leverages the whole Internet infrastructure that is already in place today.

### **Development Tools and Products**

For developers both Nokia<sup>TM</sup> and Ericsson<sup>TM</sup> provide free PC-based software simulators (device and browser) and gateway servers.

15 Major network operators as well as other companies are launching WAP services and companies that set these up for internal use – for example, Accenture<sup>TM</sup> itself (the assignee of the present invention). Common applications of WAP are the provision of information services such as city maps (SFR), weather forecasts and newsfeeds (France Telecom<sup>TM</sup>) as well as e-mail and  
20 banking (Swisscom<sup>TM</sup>).

Also other applications, known from the Internet, are brought to WAP – for instance German *Linguec*<sup>TM</sup> brings you free translations services to your mobile phone. Internet giants like AOL<sup>TM</sup> are equally investing into their WAP infrastructure and finally Nokia<sup>TM</sup> have announced to provide *Scandic Hotels*<sup>TM</sup>,  
25 the largest Scandinavian hotel chain, with WAP-based booking services.

After the first enthusiastic wave of WAP pick-up, further development of mCommerce solutions will depend on the standards' security extension. Although planned, currently no real security mechanisms are available for WAP, which is one of the standards' most important drawbacks at this point. Companies

like *Baltimore Technologies*<sup>TM</sup> and *Certicom*<sup>TM</sup> are trying to fill this hole with proprietary security solutions.

A complete list of companies providing WAP services and products, including a description of their offering, is given by the *WAP Deployment Fact Sheet*, that can be downloaded from [www.wapforum.org](http://www.wapforum.org). The document is constantly being updated.

### **Bluetooth**

Bluetooth is a short range (usually up to 10 metres, with certain restrictions even 100 metres) radio technology that enables high-speed audio- and data-transmissions between devices. The components that will be integrated into such devices are small and expected to become very cheap. Since Bluetooth operates within the globally available Industrial-Scientific-Medical 2.4 Ghz band, world-wide compatibility is ensured. In the future, Bluetooth may well replace current infrared (IrDa) technology.

The invention of the Bluetooth technology goes back to 1994. The name is derived from a Danish Viking king. In February 1998, Ericsson<sup>TM</sup>, Nokia<sup>TM</sup>, IBM<sup>TM</sup>, Intel<sup>TM</sup> and Toshiba<sup>TM</sup> decided to form the Bluetooth Special Interest Group to standardise the concept. Since then over 1500 companies, including other major players like Motorola<sup>TM</sup>, 3Com<sup>TM</sup>, Lucent<sup>TM</sup> and Microsoft<sup>TM</sup> have joined the wave. It is expected that by 2002 more than 100 million mobile phones will be equipped with Bluetooth technology.

### **Important Features of the Technical Architecture**

Key applications of Bluetooth are the synchronisation of different pieces of equipment such as mobile phones, PDAs and PCs. Additionally, there is data exchange with point-of-sale terminals, ticketing or e-wallet applications for mobile commerce might also boost the success of Bluetooth. Given its throughput of up to 2 Mbit/s, Bluetooth is also well suited for wireless LAN connectivity. This is actually where the majority of the development efforts are currently heading.

Looking at Bluetooth the following wireless main applications can be identified:

- Wireless Networking (i.e. LAN access and file transfer)
- Device Connectivity (i.e. mobile device to headset)
- 5      • Synchronisation (i.e. desktop PC to a mobile device)
- Universal Phones (i.e. mobile device to be used for local calls alike)

In order to handle the complexity that arises through the connection of so many different appliances, Bluetooth features a set of protocols to automatically identify any Bluetooth-enabled appliances in range, find out about their

10      capabilities and link them together.

IBM was the first with its *Salutation Manager*, essentially a set of easy-to-use APIs that implement these protocols. In a real system each service or object would have its own Salutation Manager and use it as a single interface to perform its own advertising and to handle communication with other Bluetooth objects.

15      Salutation Managers act as brokers and communicate among themselves on behalf of their objects, using their own specific protocol. Besides service discovery and registry, Bluetooth also standardises checking of service availability and session management.

### **Development Tools and Products**

20      The availability of Bluetooth development tools and end-user products is still very limited. In fact, only a few hardware providers such as Ericsson™ and Digianswer™ currently offer Bluetooth development Kits.

However, a variety of Bluetooth products have been announced, some of which were already demonstrated as prototypes. For example, Ericsson has

25      recently revealed its wireless headset that allows users of mobile phones to conduct calls while leaving their phone in the pocket. Also Ericsson has announced a portable device that allows browsing the Internet through a Bluetooth connection.

Other products to come are PC wireless LAN cards (TDK™,

30      Widcomm™, Acer™ and Motorola™) and a range of hands-free kits. The

constantly growing range of available and planned products is listed on sites such as [www.bluetooth.com](http://www.bluetooth.com) and [www.bluetooth.net](http://www.bluetooth.net).

### Mobile Positioning

Mobile positioning technology, based on GSM, gives the ability to locate a mobile phone geographically. GSM positioning is a key technology, which will permit the distribution of highly valuable, localised and personalised information. However, while one can do mobile positioning with Bluetooth and GSM, mobile positioning is not a main purpose of current listed standards for these technologies.

At present, it is too early to determine which of the technologies will dominate the market. The missing link will be to bring companies that provide the content together with geo-coded information, to make use of the technology.

Applications using mobile location service technologies include fleet management, vehicle tracking for security, tracking for recovery in event of theft, telemetry, emergency services, location identification, navigation, location-based information services and location-based advertising.

The following solutions exist today:

**Cellpoint™** (formerly Technor Inc.) is located in Stockholm, Sweden. Their GSM positioning solution is based on a concept called *Cell Of Origin* (COO). Here, the information of the cell that the handset is connected to is mapped against the geographical position by using a database of base stations.

The system requires no modification to the mobile terminal, but the network operator has to do some significant upgrade work. The accuracy of the system depends on the cell size. Therefore, it is usually better suited for urban areas than for rural ones.

In addition to the technology, Cellpoint offers value-added services, starting from personal position identification to locating other persons. For example, when trying to find a friend, the Cellpoint server would send an SMS message to the friend's phone that would (if disclosure of position is enabled) be

processed by a SIM Toolkit application. The phone then generates a reply, containing the current cell information, and returns it again via SMS. The Cellpoint server can then map the cell information contained in the SMS to a geographical location.

5

**Ericsson™** provides a proprietary GSM positioning technology, called *Enhanced Observed Time Difference* (E-OTD) that is currently only available for networks based on Ericsson switches. Ericsson's *Mobile Location Center*, calculates the phone's position. It works by comparing the relative times of arrival, at the handset and at a nearby fixed receiver, of signals transmitted by the underlying mobile network base stations. The E-OTD system overlays an existing mobile network.

The advantage of this technology is that it allows an accurate and consistent quality of service, independent of the network density at the user's location. Both ETSI and ANSI have decided to jointly develop a GSM mobile positioning standard, based on Ericsson's system.

**Alcatel™** provides GSM positioning services through an SMS-based system similar to the Cellpoint one. However, Alcatel offers a WAP-based user interface to access these services, which consists of the transmission of graphical street maps to the mobile handset. Among Alcatel's technology partners for these solutions are *GEMPLUS™* and *Webraska™*.

**Cambridge Positioning Systems™** is a UK-based start-up company that provides a GSM positioning system named *CURSOR*. The system works using triangulation and signal timing between base stations in reach of the handset. The actual calculation is conducted on the network side every time the mobile phone changes base station, so that the information is already available when requested. The accuracy of this system is said to be around 50m of range.

## Binary SMS

The success of SMS, especially among the younger consumers, urges network operators and equipment manufacturers to provide more and user friendly services. This is why Nokia has created its proprietary *binary SMS* standard.

- 5            Binary SMS encodes binary data in normal SMS messages, thereby enabling mobile handsets (provided they support this functionality) to receive and send images and ring tones.

Today several network operators offer Internet portals, where customers can select icons and ring tones and have those sent directly to their mobile phone.

- 10          Some examples are French *Bouygues Telecom*<sup>TM</sup> ([www.musicformobile.fr](http://www.musicformobile.fr)), Finnish *Sonera*<sup>TM</sup> and German *Mannesman*<sup>TM</sup>.

The last two have developed their services using an API provided by Finnish Akumiitti<sup>TM</sup>. This product provides support for sending of ringing tones, icons, picture messaging and chat services.

- 15           However, given that binary SMS is a proprietary standard, it is currently limited to Nokia phones only. Provided that the number of SMSs are sent directly from one handset to another, Nokia has also developed a messaging platform named *Artus*<sup>TM</sup>, to cover “mobile-to-mobile” picture messaging.

- 20           From this description of current technologies, it can be concluded that:

- 1) Payment solutions exist “en masse”, however, only very few are designed to work for mobile commerce (ehpt, Paybox);
  - 2) Smartcards are widely accepted and will increase in importance and capabilities (memory capacity, processing speed);
  - 3) SIM Toolkit is established and widely used, however, it will eventually be replaced by WAP;
  - 4) WAP, Bluetooth and GSM Positioning are only just emerging, but will have the most substantial impact on the future of mobile commerce.
- 25
- 30



In the preferred embodiment of the present invention, a subset of these technologies has been chosen to create a demonstrable prototype that showcases the use of such technologies. The preferred embodiment of the present invention is now described in more detail.

5

## **THE PREFERRED EMBODIMENT**

The starting-point is the basic proximity device, a Bluetooth chip that can be incorporated in the smallest, lightest mobile phone. With any Bluetooth-enabled machine – a drinks dispenser, photocopy machine, petrol pump or parking meter, for instance – the user can place an order, receive the goods and pay for them electronically via a hand-held device.

In a preferred embodiment, the invention can be used for other purposes, such as accessing the drink vendor's website or using their telephone system. And from the drink vendor's viewpoint, if the company already has an avenue of communication to a customer, they can exploit it to offer other services – perhaps from other suppliers who will be happy to pay a percentage to their new partner. For example, some marketing companies might be happy to offer a free Coke to any customer prepared to give a moment of their time to answer a question or two. And for an impoverished student, such an offer might well be irresistible.

This new marketplace is what applicants call the Bluetooth Service Portal (BSP). Once users have established a connection via BSP, in alternate embodiments users can access additional services. Using their mobile phone to connect to the Internet, a user can be able to choose from a wide range of products and services as and when they want them.

For example, in an alternate embodiment if a customer is using BSP in connection with their Xerox copier, they might wish to order more copy paper, and perhaps additional office supplies at the same time. The overwhelming attraction is that this conduit is absolutely free. Even though you are using your wireless phone, it won't show up on your monthly bill. From the vendor's viewpoint, it is easy to envisage a massive variety of services that Xerox might offer its customers via BSP.

In an alternate environment, Bluetooth technology enables the customer to record preferences, so that, for instance, every time they pass a drinks machine, the machine will be programmed to dispense the customer's favourite drink. But this in turn provides the vendor with customer information that makes it much easier to tailor product offerings in accordance with customer preferences. In still another alternate embodiment, the personalisation of products can be extended, such as for example, a simple prompt from the Bluetooth-enabled phone would communicate with another chip in the car and adjusts the seats, mirrors and steering-wheel to the individual driver before the door is opened.

More specifically, in the preferred embodiment, assume it's a nice and hot day and you are walking by a vending machine that sells drinks. You are very thirsty, but unfortunately you do not have any coins with you. Additionally, you are in transit through a different country and you didn't even pick up foreign currency.

In the preferred embodiment, the drink list of the vending machine, including prices, would automatically appear on your mobile phone's display. So all you would need to do is to select your drink and type in your Qpass™ password, that you are using for your Internet purchases anyway, in order to authenticate.

Your Qpass Membership ID, that happens to be the unique serial number or your phone number, would be requested from the handset directly, taking away the hassle of having to punch this one in. Nonetheless the security of your "mobile wallet" would be granted, since you need to know the secret PIN to unlock your mobile phone upon power up, plus you need to be in possession of the physical device itself.

The vending machine would now drop your can of Coke and you could relax and enjoy your drink. You know that Qpass will send you a detailed bill, with all your purchases at the end of the month, and charge the overall amount to your credit card.

The exemplary embodiment of the present invention will discuss this scenario in more detail below.

In the discussion which follows, the following glossary applies:

ETSI European Telecommunications Standard Institute

GPRS General Packet Radio Service

GSM Global System for Mobile Communications

5 OTA Over The Air uploading of modified SIM Toolkit applications

SIM Subscriber Identification Module

SMS Short Message Service

SMSC Short Message Service Center

SS Supplementary Service

10 STK SIM Application Toolkit (short: SIM Toolkit)

USDD Unstructured Supplementary Services Data

USSD Unstructured Supplementary Service Data

VAS Value Added Services

#### 15 **Mobile device commands**

In the preferred embodiment, an exemplary set of mobile device commands are shown in the document titled "Nokia 6090 AT-command set and interfaces" Outline version 1.31 dated 27 March 2000, which is hereby fully incorporated herein by reference.

20 The following describes both a high- and a low-level architecture of how an exemplary system of the present invention is implemented.

In **Figure 3** an exemplary system is used to demonstrate the usability of the described technologies, in a concrete, useful and discrete application: an *Internet Micropayments to the Real World* scenario. In **Figure 3** the following  
25 exemplary technology is used:

#### **Hardware**

- a Sielaff™ vending machine, equipped with an RS232 interface to connect it to a PC

- an Ericsson™ Bluetooth-enabled phone

30 • a Digianswer™ PCMCIA Bluetooth card

## Software

- Sun JAVA 2 JDK 1.3 (for PC side server development)
- Manufacturer SDKs
- Qpass™ server.

5

Turning now to Figure 3 a system comprising the following pieces is shown: a vending machine 301 of type Sielaff FK 185 EC with a RS232 interface 305 connected to a Compaq Laptop 307 with Digianswer Bluetooth card. The laptop computer 307 runs custom-written software that simulates a virtual vending machine, sends commands to the real physical one (if connected) and handles transactions with a Qpass service center 311. The Qpass service center 311 is itself connected to the consumer's bank by way of of the user's credit card account 313. Finally, an Ericsson T28s mobile phone 309 with a wireless transmission channel adapter and a SIM card running custom-written software and using SIM Application Toolkit features is provided. With this exemplary configuration, the Compaq laptop 307 has an wireless transmission channel adapter (or in the future a special component to be integrated into the vending machine) and runs custom-written software (WUMPI logic of the present invention) that simulates a virtual vending machine and sends commands to the real machine 301, and handles transactions with Qpass 311. In this simple exemplary application, the vending machine 301 transmits its advertising/offer via its wireless transmission channel to mobile devices in range 315 which causes the mobile device 309 to display the advertising/offer. The user identifies himself (via a PIN) and selects one of the offered products 317. A SIM Toolkit Application on the mobile device 309 sends the selection and the WUMPI logic on the laptop 307 forwards transaction information throughout the network 319 to the operator payment provider 311. The payment provider 311 logs the transaction and adds it to the consumer's bill or deducts amount from the consumer's prepaid account 323 and returns a grant of payment signal to the virtual vender (laptop in this case) 321 who in turn signals 325 the vending machine to dispense the selected product.

Turning now to **Figure 4** a block diagram of the functional architecture of the exemplary computer system is indicated. Once again a mobile device with an wireless transmission channel modem **401** is assumed to be within range of the vending device containing an embedded computer **405**. In this case the computer platform **405** has an extended systems wireless transmission channel PC adapter **402**. Coupled to the computer platform **405** is a Sun JAVA communications Application Program Interface (API) system **407**, **409** and an MS SQL Server module **419**. Couples to the Sun JAVA communications API system **407** a WUMPI product Interface control module **411** which itself is coupled to a WUMPI Phone MMI control module **413**, a WUMPI main module **415** and a WUMPI Qpass Module **417**. The WUMPI Qpass Module **417** is coupled to the MS SQL Server module **419** which is coupled to a Qpass control station Qpass engine **421** and a MS IIS server **423**. The Qpass control station Qpass engine **421** provides the communications services to the Qpass service center **425**.

## Requirements

To run the Mobile Service Link (WUMPI) prototype, you will need the following:

### Hardware

- 1 Ericsson Mobile Phone T28s or R320s
- 1 Ericsson Mobile Office IrDA modem adapter DI-28<sup>8</sup>
- 1 GSM SIM card<sup>9</sup>
- 1 Extended Systems serial IrDA adapter Jet Eye PC
- 1 Standard Intel PC or Laptop<sup>10</sup>
- 1 Sielaff vending machine FK-185 ECX with RS232 interface

### Software

- 1 Mobile Service Link Installation CD-ROM
- Note this software system is described functionally below.

<sup>8</sup> Only in combination with an Ericsson T28s phone (the R320s has an integrated IrDA modem).

<sup>9</sup> A SIM card is only needed to power the phone up. The demo works fine without network connection (i.e. in the United States) and with an expired SIM card.

<sup>10</sup> The PC should be reasonably fast (PII-400 or above) for the video animations.

## **Operating System**

- Please note that the Mobile Service Link prototype best runs under a Windows 9x environment. Installation under Windows 2000 and Windows NT4 is possible (necessary drivers are provided on the Mobile Service Link CD), however, cumbersome due to missing native IrDA support.

The simulation version (without IrDA communication and phone interaction) will install and run fine on any system configuration.

### **10 Set-up**

The set-up procedure for the Mobile Service Link demo consists of running the automatic Mobile Service Link installer and making some additional manual modifications afterwards.

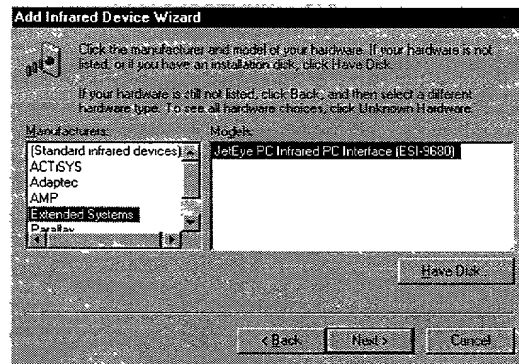
### **15 During the Mobile Service Link Set-Up**

To install the Mobile Service Link demo, insert the Mobile Service Link Installation CD-ROM into the CD-ROM drive of your PC. The Install Shield set-up should launch automatically (if it does not, run *SETUP.EXE* from the CD's root directory). Follow the installation instructions.

- 20 The installer will install the Mobile Service Link demo and launch the installers of the required third-party components (Microsoft Infrared Driver 2.0, Sun Java 2.0 JDK 1.3 and Sun Java Media Framework 2.1). It is generally recommended to use the default settings of the setups.

### **25 Microsoft Infrared Driver 2.0 (Windows 9x Setup)**

Choose the appropriate wireless transmission channel device when prompted by the Microsoft Infrared Driver set-up (Internal IrDA driver or Extended Systems JetEye PC).



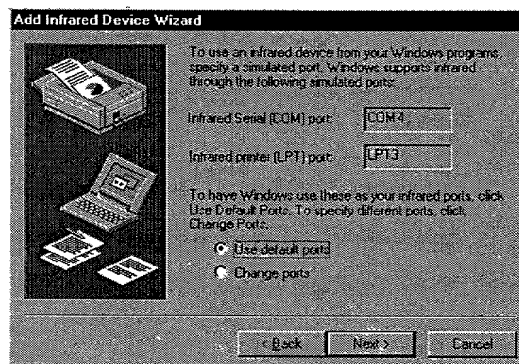
*Selecting an infrared device*

Select the physical COM port to which you will attach the wireless transmission channel device (in case you are using an external one).



*Selecting a COM port to attach to*

Finally make sure, that the wireless transmission channel driver will provide application support with a virtual port setting of *COM4*.



*Selecting the virtual COM port*

**Note:** If this port is not available in the list, you may have to uninstall an existing wireless transmission channel driver first and then rerun the set-up manually from the *Install\MSIR20* folder.

### Ericsson Communications Suite 1.2.2 (Windows 2000 Setup)

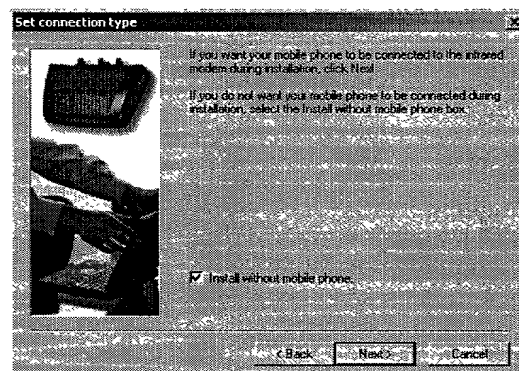
Getting the Mobile Service Link demo to run under a Windows 2000 environment is problematic, due to missing support for a virtual COM port. However, Ericsson provides a driver within its *Communications Suite*, that

5 enhances the built-in IrDA driver with a virtual COM port.

Nevertheless setup still is a hassle and may very likely require manual adjustment. It has proven to work best with the built-in IrDA port of a laptop, rather than by using an external Extend Systems JetEye PC IrDA adapter.

When you encounter the subsequent screen during setup of the

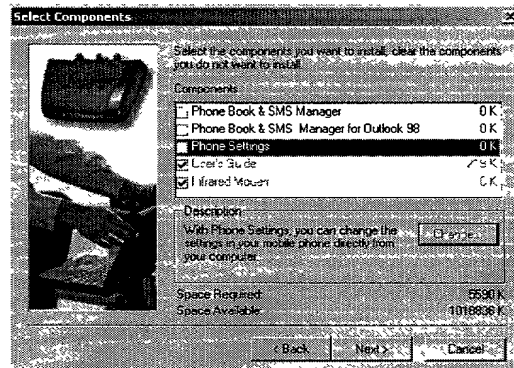
10 Communications Suite, make sure you check the *Install without mobile phone* checkbox.



*Installing without mobile phone*

15 Subsequently you will be prompted to select the software components you wish to install. You can deselect all but the mandatory components, since the basic IrDA driver is really all you need.





*Deselecting unneeded components*

5 The Communications Suite will usually install a virtual COM port in the range of COM7 or COM13 (check Windows 2000 Device Manager for actual port). You need to modify the batch files, located in *C:\MobileServiceLink* folder, that are used to start the Mobile Service Link demo in order to reflect this port setting (batch files are pre-installed with a setting of COM4).

#### **Extended Systems Quick Beam Suite 3.4 (Windows NT4)**

10 Getting the Mobile Service Link demo to run under a Windows NT4 environment is problematic, due to missing support for a virtual COM port. However, Extended Systems provide a driver within its *Quick Beam Suite*, that enhances Windows NT4 with an IrDA driver that supports a virtual COM port.

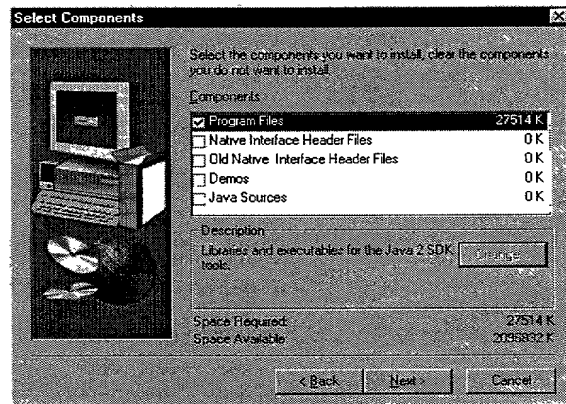
15 Nevertheless setup still is a hassle and may very likely require manual adjustment.

Follow the setup steps as suggested by the Quick Beam Suite and preferably select a virtual COM port setting of COM4. Otherwise you will need to modify the batch files that are used to start the Mobile Service Link demo (located in *C:\MobileServiceLink* folder) in order to reflect this port setting (batch files are pre-installed with a setting of COM4).

20

### Sun Java 2.0 JDK 1.3

You need only install the option *Program Files*.



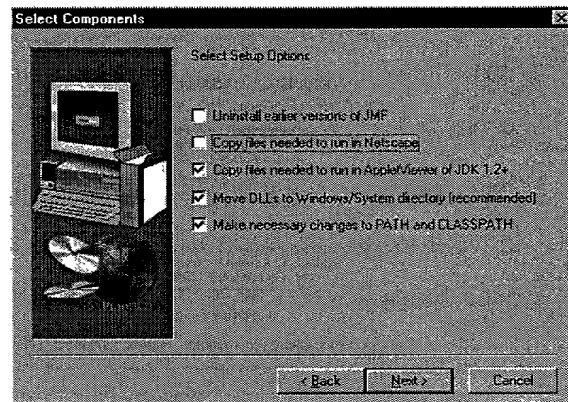
*JDK 1.3 required options*

- 5 Do **not** reboot if prompted following set-up.

**Note:** since a JDK will be installed with which the Mobile Service Link demo has been tested, no other JDK should be present on the same machine.

### Sun Java Media Framework 2.1

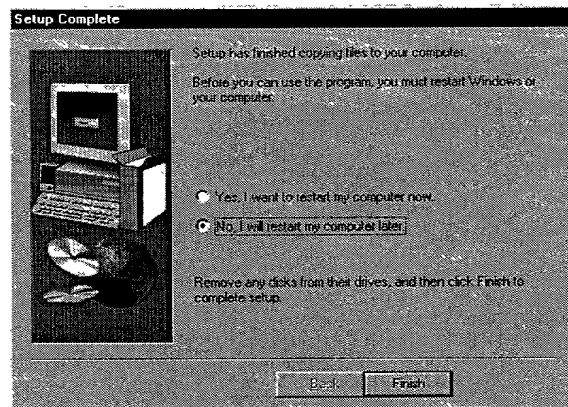
- 10 In case you have a previous version of JMF installed, select to uninstall it first. Otherwise deselect the uninstall option. You do not need to install support for Netscape.



*: JMF 2.1 required options*

- 15

Do **not** reboot when prompted following set-up.



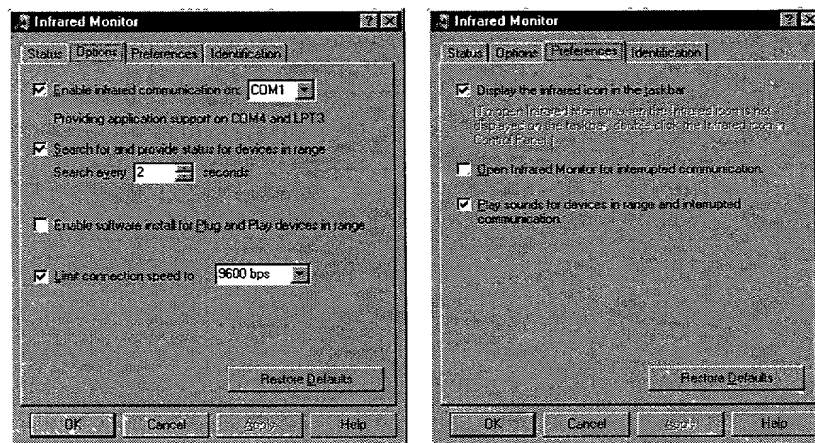
*Select No, when prompted to reboot*

- Only after the entire Mobile Service Link installation (including all 3 third party setups) has completed, reboot your machine. You will find a Mobile Service Link folder in your Start menu.

### Manual Steps Following Mobile Service Link Set-up

- When the overall Mobile Service Link installation has completed and you have rebooted your system, please perform the following manual modifications before running the demo.

### Microsoft Infrared Driver 2.0 (Windows 9x Environment)



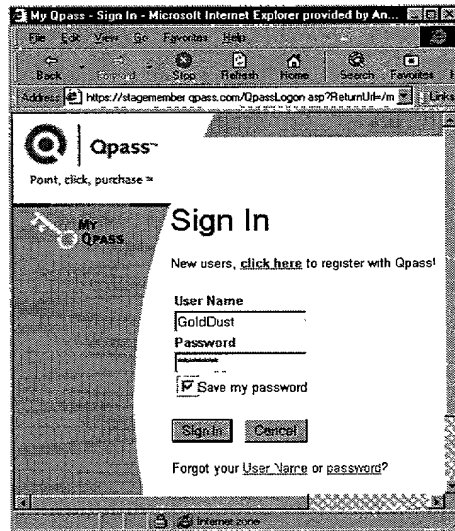
*: Microsoft Infrared Driver Set-Up*

- Launch the *Microsoft Infrared Monitor* from *Settings* → *Control Panel*. Make sure the Options and Preferences settings match the ones shown in the

Microsoft Infrared Driver Set-Up Figure above.

### Qpass Membership Account

- In case you requested so, a Qpass user account will have been setup for  
5 you in order to run the live demo.



Qpass Sign-In

- In order to access your account launch Internet Explorer and go to  
*sandmember1.qpass.com* using the *https* prefix. This will bring up the Qpass log-  
10 in page (see Qpass sign in Figure above). Bookmark this page. Use your phone's  
IMEI number (printed inside the phone behind the battery) as user name and your  
password. Check the *Save Password* option.

The first time you click *Sign In*, another page will appear, requesting an e-  
mail address for verification.

### 15 Setting up the Vending Machine

In case you have a real physical vending machine of type Sielaff  
FK 185 ECX, you will need to make some manual modifications before you can  
attach it to a PC controller.

- First of all you will need to create a cover for the right-hand side of the  
20 machine, in order to hide the coin slot and buttons. The cover should preferably be

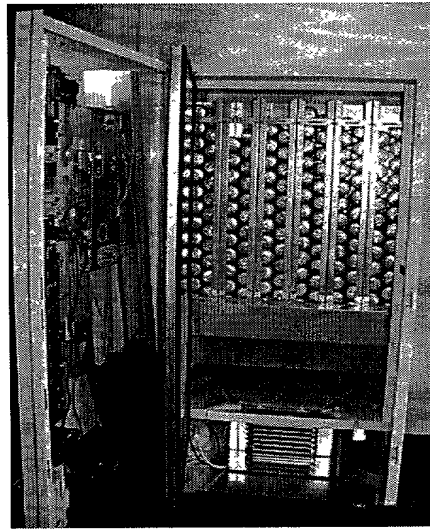
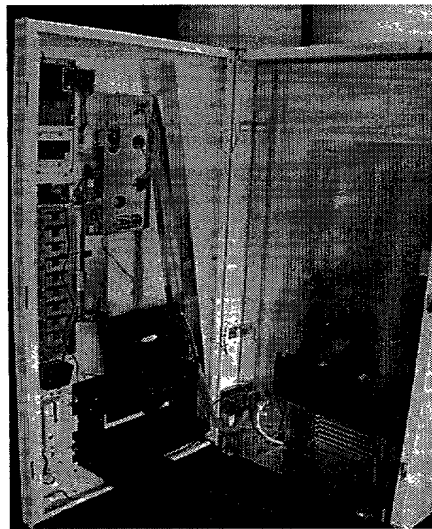
a piece of resistant, white, plastic with size 1660mm x 197mm x 4mm (broad x height x depth) and round edges.

At the position where the coin slot used to be, it shall contain a square hole for the wireless transmission channel adapter, with size 40mm x 30 mm (broad x height) and with the upper left corner located 500mm from the top and 85mm from the left of the cover.

The cover can be attached to the vending machine using velcro tape. This allows easy removal in order to access the lock to open and refill the machine.

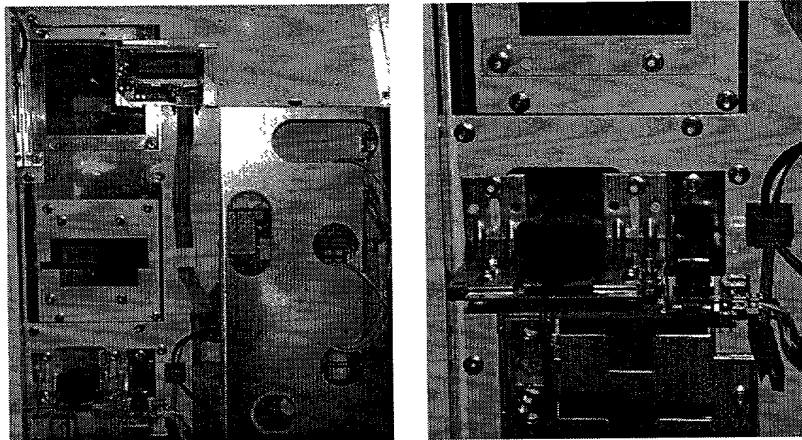
On the inside of the machine you shall fix the wireless transmission channel receiver in the right position, mount the display towards the inside of the machine, detach and remove the drink selection keys and connect the PC (preferably a laptop) to the RS232 interface of the machine.

**Note:** you must use a NULL-modem cable (crossed serial cable) to connect the PC to the vending machine.



When everything has been modified and the PC is installed and connected to the wireless transmission channel receiver and the vending machine, you need to set the vending machine to free delivery mode.

- 5 In order to do this, use the keypad located on the inside of the machine and type (keys symbolized by square brackets): [M], [7], [E], then repeatedly [M] until the display says "KREDITSYSTEM", then repeatedly [1] until the display



says "FREIVERKAUF", then [E] to confirm the selection, and finally repeatedly [L]+[M] together until the display says "BETRIEBSBEREIT".

- 10 Now all that is left is to fill up the vending machine with drinks. Each column takes around 80 cans, so the whole machine takes around 480 cans.

**Note:** the vending machine is built for European power supply (230V / 50 Hz). So for usage in the US or other countries you will need a power transformator that converts from the local power standard to the European one.

- 15 Although this should not give any problems, the manufacturer does not take over any warranty in this case.

#### **Demo Instructions**

The following gives a step-by-step run through description of a typical Mobile Service Link exemplary demonstration.

## Preparation and System Start

Switch on your mobile phone and click on the IrDA modem adapter if you are using an Ericsson T28s. If you are asked to enter a PIN code, the default code is **0000**.

- 5           If you are running the demonstration without a real vending machine, you should set the audio level of the demonstration PC high enough to be sure that you can hear it, even with the audience talking. This is to give you audible confirmation for the status of the IrDA connection, otherwise you may never know if the connection has been established or not. If a real vending machine is
- 10   attached, audible confirmation is not necessary, since the machine will light up once a phone has been detected.

- Microsoft's IrDA Monitor will beep once if it detects the phone and will continue beeping if the connection is lost while open. Try the connection once, by holding the phone's IrDA port to the IrDA port of the PC/Vending Machine. Do
- 15   this to check that the volume is high enough and to investigate the best distance and angle for the demo as well. A good distance is usually between 1 and 3 meters, depending on the light. You should try to hold the phone in a horizontal position.

- To launch the demo, use one of the shortcuts that have been installed in
- 20   the Mobile Service Link folder of your Start menu. The following shortcuts are installed by default.

### Mobile Service Link Online

- In this configuration purchases are processed real-time with the Qpass account that corresponds to your mobile phone. The account's Membership ID
- 25   (the serial number of the mobile handset) and the password you enter will be used for authentication and transaction processing. You need an Internet connection and a Qpass account for your specific phone to run the demo with this set-up.

### Mobile Service Link Offline

In this configuration, transaction processing with Qpass is only simulated. The password you enter will be authenticated, but no purchases will be registered with Qpass.

- 5        This set-up should be used if no Internet connection or Qpass account is available, or if the demo needs to be kept brief.

### Mobile Service Link Override

- 10       In this configuration, purchases are processed real-time with the default Qpass account (Membership ID: *Mobile Service Link*, Password: *Mobile Service Link*). This account will override the serial number of the mobile handset and the password you enter. Authentication will therefore always succeed. You need an Internet connection to run the demo with this set-up.

This set-up should be used if no specific Qpass account for your mobile handset has been set-up, but you still want to show live transaction processing.

- 15       **Mobile Service Link Simulation**

In this configuration, a one-drink purchase is simulated without interaction with a mobile phone. A drink will be chosen at random. The timings are set in a way that allows the presenter to explain what is happening. No transactions will be processed by Qpass.

- 20       This set-up should be used if no mobile phone or wireless transmission channel adapter is available.

Depending on your needs, you may want to launch the demo manually. To do so, open a command prompt and change to the Mobile Service Link root directory by typing *CD \Mobile Service Link* (followed by the *RETURN* key).

- 25       Then start the demo with the command *run <Parameters> <Switches>* (followed by the *RETURN* key). Parameters and switches are defined as follows :

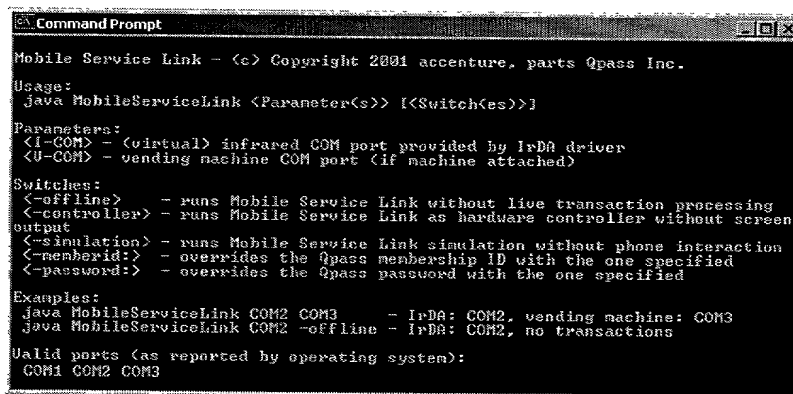
### Mobile Service Link Controller

This configuration is reserved for use with a real vending machine only. The software acts as a pure controller and no graphical user interface and no



videos will be displayed. Text-based debug information will be output to the console instead.

The simplified interface allows to run the demo on less powerful machines.



```
Command Prompt
Mobile Service Link - (c) Copyright 2001 accenture, parts Qpass Inc.
Usage:
java MobileServiceLink <Parameter(s)> [<Switch(es)>]
Parameters:
<I-COM> - (virtual) infrared COM port provided by IrDA driver
<V-COM> - vending machine COM port (if machine attached)
Switches:
<-offline> - runs Mobile Service Link without live transaction processing
<-controller> - runs Mobile Service Link as hardware controller without screen
output
<-simulation> - runs Mobile Service Link simulation without phone interaction
<-memberid:> - overrides the Qpass membership ID with the one specified
<-password:> - overrides the Qpass password with the one specified
Examples:
java MobileServiceLink COM2 COM3 - IrDA: COM2, vending machine: COM3
java MobileServiceLink COM2 -offline - IrDA: COM2, no transactions
Valid ports (as reported by operating system):
COM1 COM2 COM3
```

5

#### <I-COM>

This parameter represents the serial port that will be used to communicate with the wireless transmission channel driver. This is a virtual port, provided by Microsoft's Infrared Driver (see installation notes). The default setting is COM4.

- 10 This parameter may be omitted if the demo is run in simulation mode.

Example: *COM4*.

#### <V-COM>

- 15 This parameter represents the serial port that will be used to communicate with the vending machine. If no vending machine is attached, this parameter should be omitted.

Example: *COM2*.

#### <-offline>

- 20 This switch runs the demo without performing live transactions with Qpass. This allows you to show the prototype without an Internet connection

and/or Qpass account.

#### **<-controller>**

- 5 This switch runs the demo without a graphical user interface. This allows old and slow machines to act as a pure vending machine controller without showing graphical details and video sequences.

#### **<-simulation>**

- 10 This switch runs the demo as a pure simulation without the need for a mobile phone or wireless transmission channel adapter. However, a real live transaction (drink chosen by random) with Qpass will take place, unless this switch is combined with the <-offline> switch.

#### **<-memberid:>**

- 15 This switch overrides the Qpass Membership ID retrieved from the mobile phone (serial number of the handset) with the membership ID specified. It therefore allows transactions to be re-routed to a specific Qpass account. This is useful if you do not have a Qpass account set up for your specific mobile phone.

Example: *-memberid:Mobile Service Link.*

- 20 **Note:** the default Mobile Service Link Qpass account that may be used with any mobile phone has Membership ID *Mobile Service Link* and password *Mobile Service Link*.

#### **<-password:>**

- 25 This switch overrides the Qpass Password entered on the mobile phone (punched in by the user) with the specified password. It therefore allows transactions to be re-routed to a specific Qpass account. This is useful if you do not have a Qpass account set up for your specific mobile phone.

Example: *-password:Mobile Service Link.*

**Note:** the default Mobile Service Link Qpass account that may be used with any mobile phone has Membership ID *Mobile Service Link* and password *Mobile Service Link*.

### **Simulation View**

- 5           The upper left-hand corner shows dynamic video sequences dependent on what the presenter does on the real phone. This is to show groups of people what is happening on the phone's display, without having to gather everybody around the phone itself.

### **Selected Product**

- 10           In the upper middle part of the screenshot, you can see which drink has been chosen. As soon as the user selects a product, the specific drink is highlighted with a yellow blinking border.

### **Execution Log**

- 15           The upper right-hand corner displays detailed plain text execution information. A history of the 100 most recent messages is kept, so that you can scroll up and down to see previous messages.

### **Architecture View**

- 20           The main part of the window illustrates the prototype architecture and highlights the entities that are active at each point in time with a yellow blinking border.

### **Presenting the Demo**

- It is mentioned that in a fully configured system, the laptop would be a tiny and comparatively cheap PC component integrated directly into the vending machine.
- 25           The desk on which the PC's IrDA port is mounted in the exemplary demonstration described above is supposed to be the vending machine and that the IrDA port would usually be integrated into the front side of the machine. The phone and the IrDA port would be on it.

          At the start of the example, the accessory menu is empty before you start.

The vending machine then proceeds to scan for phones in range, so as you walk into range holding the phone so that its IrDA port points to the PC's IrDA port a detection should be made. Once the connection is established, Go to the *Extras* menu of the phone and select the *Accessories* submenu. You can navigate  
5 using the phone's arrow- and yes/no-keys. You will see another submenu called *Mobile Service Link*. Select this one as well. You will be prompted for your Qpass PIN code to log on. There is no need to type the Qpass Membership ID, since you can use the phone's globally unique serial number that is read directly from the handset. This is an advantage since you want to avoid all unnecessary  
10 typing on the phone.

The Membership ID and the PIN code are now sent to the Qpass server to authenticate the user. What you entered can be seen in the *Execution Log*.

If the authentication failed, you return to the log-in page for a second try. This time you type in the correct PIN code. When the second attempt at  
15 authentication has been successfully completed the drinks list will be displayed. Select an item from the list by using the arrow-keys. Confirm your selection with *yes*.

A message will ask you to confirm the purchase and display the price of the beverage. Again press *yes*.

20 The transaction has now been transmitted to the Qpass Service Centre and is being processed. The Qpass Service Centre will confirm or refuse it depending on your credit limit. Once the transaction has been completed the user could go directly to the personalised Qpass member web site and see that the purchase has been registered.

25 After the transaction has succeeded, the can of drink will be released.  
**Note:** you may walk out of IrDA range with the phone and temporarily lose the connection. This is no problem, unless you do not get back within **60 seconds**. Be sure the connection is re-established before you continue (beeps indicating the loss of connection should stop).

30 The phone will now ask you if you'd like to purchase another drink. Press *yes* and the user returns directly to the drinks list instead of to the log-on screen.

Next time you are prompted to conduct another purchase answer *no*. The phone will then display a final “Thank you” message for using the Qpass service. Note that this message, just like all the others that were displayed throughout the demo, could well also be used for dynamic advertising, since it is being generated on the  
5 PC side.

If the demo was run with live transaction processing enabled, open up the Internet Explorer Web browser, which should be configured to directly bring up the Qpass member homepage associated with your phone.

Log on (Membership ID and password should be stored) and go to  
10 *Statements* and then *Current Statement*. The purchases have actually been registered.

**Note:** it may take 1-2 minutes from the transaction to the moment where the purchase is listed on the web page.

This exemplary Mobile Service Link discussion describes how the  
15 invention performs the follows actions:

### **Hijacking the Phone**

The Mobile Service Link (WUMPI) invention is not just another one of “dial-a-drink” mechanism. The vending machine has been chosen because it is a very visual example of the inventions ability for products taking control of mobile  
20 phones (as the one wireless universal mobile device that everybody has these days) as their interface to offer services as users walk within range.

For example, you could also imagine using the phone to unlock your car or to modify printer settings on a laser printer without any buttons.

### **Micropayments to the Real World**

Another difference in this invention is the use of a micropayment solution  
25 instead of charging the purchase to your phone bill. Until today, all micropayment systems, without exception, were only designed to conduct purchases for digital goods such as information, news and music.

Applicants invention, for the first time, demonstrates a possible extension  
30 of these systems to a complete marketplace, including physical goods and services.

### **Bypass the Network Operators**

Although the Mobile Service Link concept of applicants' invention uses a mobile phone, the architecture completely bypasses the wireless network. No calls are made, no SMSs sent, no costs show up on the user's phone bill. The great advantage of using the mobile phone is that almost everybody has one, and even more importantly: everybody knows how to use it.

### **Ease-of-Use**

Compared to other "dial-a-drink" systems, the Mobile Service Link of applicants' invention has a user interface is very user-friendly. There is no need to type or dial a long phone number, the transaction is quick and it doesn't create additional costs. As soon as the user feels thirsty and looks at the phone's display, the drinks list is already there.

The following provides an exemplary embodiment of the current WUMPI phone control technology which makes use of an Erickson R320s mobile device with IR port, a PC with an IR attachment connected to the vending device, and a JAVA application on the PC which talks via the PC's IR port to the IR port on the mobile device, whereby the user can choose an item displayed on the phone's menu by using the buttons on the phone. Those skilled in these arts will recognize many ways to program the various modules to interact with one another, and therefore we only below an exemplary embodiment of the Main module, the Phone module and the Vending Machine module, and these modules may be implemented in many ways as those skilled in these arts will recognize.

\*  
25 \* (c) Copyright 2001 Accenture - all rights reserved.  
\*/

/\*\*  
\* The Mobile Service Link main application.  
\*/  
30 MobileServiceLink(String portNameIrDA, String portNameBluetooth,  
String portNameSielaff, boolean offlineMode, int mobileServiceLinkMode,  
String QpassMemberIDOverride, String QpassPasswordOverride)  
{  
long startTime;

Iterator iterator;

```
// Save command line settings.
5  this.portNameIrDA      = portNameIrDA;
   this.portNameBluetooth = portNameBluetooth;
   this.portNameSielfaff   = portNameSielfaff;
   this.offlineMode        = offlineMode;
   this.mobileServiceLinkMode = mobileServiceLinkMode;
10  this.QpassMemberIDOverride = QpassMemberIDOverride;
   this.QpassPasswordOverride = QpassPasswordOverride;

   if(offlineMode)
   {
15     addToExecutionLog("Offline mode selected - no live transactions...");
   }

   if(mobileServiceLinkMode == modeController)
   {
20     addToExecutionLog("Controller mode selected - output to console...");
   }
   else if(mobileServiceLinkMode == modeSimulation)
   {
25     addToExecutionLog("Simulation mode selected - demo will run without
        phone...");
   }

   // Load product list.
   if(!loadProductList())
30   {
       System.exit(-1);
   }
   addToExecutionLog("Loaded product list...");

35  // Open window only if not run in controller mode.
   if(mobileServiceLinkMode != modeController)
   {
       // Setup event listener for main window.
       WindowListener windowListener = new WindowAdapter()
40   {
       public void windowClosing(WindowEvent e) { System.exit(0); }
       public void windowClosed(WindowEvent e) { System.exit(0); }
   };

45  // Create and load pictures.
   logos      = new Picture(pictureLogos);
```

```

        products          = new Picture(pictureProducts);
        architectureOverview = new Picture(pictureArchitectureOverview);
        highlightVendingMachine = new
5      Picture(pictureHighlightVendingMachine);
        highlightLaptop      = new Picture(pictureHighlightLaptop);
        highlightPhone       = new Picture(pictureHighlightPhone);
        highlightServiceCenter = new Picture(pictureHighlightServiceCenter);
        highlightQpass       = new Picture(pictureHighlightQpass);

10      // Create video player.
        videoPlayerPanel.setBorder(new TitledBorder(new
        BevelBorder(BevelBorder.RAISED), "Simulation View"));

        // Create selected product panel.
15      selectedProductPanel.setBorder(new TitledBorder(new
        BevelBorder(BevelBorder.RAISED), "Selected Product"));
        selectedProductPanel.add(products);
        iterator = productList.iterator();
        while(iterator.hasNext())
20      {
            // Add the product's highlighting picture to the panel.

        selectedProductPanel.add(((Product)iterator.next()).getHighlightingPicture
        (), 0);
25      }

        // Create execution log.
        executionLogPanel.setBorder(new TitledBorder(new
        BevelBorder(BevelBorder.RAISED), "Execution Log"));
30      executionLogPanel.add(executionLog);

        // Create architecture overview.
        architectureOverviewPanel.setBorder(new TitledBorder(new
        BevelBorder(BevelBorder.RAISED), "Architecture Overview"));
35      architectureOverviewPanel.add(highlightVendingMachine);
        architectureOverviewPanel.add(highlightLaptop);
        architectureOverviewPanel.add(highlightPhone);
        architectureOverviewPanel.add(highlightServiceCenter);
        architectureOverviewPanel.add(highlightQpass);
40      architectureOverviewPanel.add(architectureOverview);

        // Setup main window.
        frame.addWindowListener(windowListener);
        frame.add(videoPlayerPanel);
45      frame.add(logos);
        frame.add(selectedProductPanel);

```



```

frame.add(executionLogPanel);
frame.add(architectureOverviewPanel);
frame.pack();
frame.setSize(windowWidth, windowHeight);
5 frame.setBackground(new Color(204, 204, 204));
frame.toFront();
frame.show();

// Setup video player.
10 videoPlayerPanel.setBounds(10, 25, videoWidth+20, videoHeight+30);

// Setup logos.
logos.setBounds(362, 40, 300, 125);

15 // Setup selected product panel.
selectedProductPanel.setBounds(videoWidth+20+10, 175,
windowWidth-videoWidth-30-logWidth-30, 120);
products.setBounds(12, 18, 300, 95);
iterator = productList.iterator();
20 while(iterator.hasNext())
{
// Add the product's highlighting picture to the panel.
Product product = (Product)iterator.next();

25 product.getHighlightingPicture().setBounds(product.getHighlightingPicture
X(), product.getHighlightingPictureY(),
product.getHighlightingPictureWidth(),
product.getHighlightingPictureHeight());
}

30 // Setup execution log.
executionLog.setFont(new Font("Arial", Font.PLAIN, charSize));
executionLog.setBounds(10, 20, logWidth, logHeight);
executionLogPanel.setBounds(windowWidth-logWidth-30, 25,
35 logWidth+20, logHeight+30);

// Setup architecture overview.
architectureOverview.setBounds(40, 15, 944, 437);
architectureOverviewPanel.setBounds(10, windowHeight-437-25-10,
40 windowWidth-20, 437+25);
highlightVendingMachine.setBounds(40, 22, 113, 207);
highlightLaptop.setBounds(297, 86, 94, 100);
highlightPhone.setBounds(313, 349, 75, 89);
highlightServiceCenter.setBounds(547, 69, 117, 107);
45 highlightQpass.setBounds(840, 105, 115, 49);
}

```

```

// Create the highlighter thread and get it going.
pictureHighlighter = new PictureHighlighter(this);
pictureHighlighter.start();
5
// Create the vending machine module.
vendingMachineModule = new VendingMachineModule(this);

// Handle one connection after another.
10 try
{
    while(true)
    {
        // If a COM port for IrDA was specified open it.
15         if(portNameIrDA != null)
        {
            addToExecutionLog("Opening IrDA port " + portNameIrDA + "...");

            // Get port identifier and open the COM port for IrDA.
20             portId = CommPortIdentifier.getPortIdentifier(portNameIrDA);
            portIrDA = (SerialPort)portId.open("Mobile Service Link IrDA Port",
2000);

            // Parametrize COM port.
25             portIrDA.setSerialPortParams(9600, SerialPort.DATABITS_8,
            SerialPort.STOPBITS_1, SerialPort.PARITY_NONE);

            // Set flow control mode.

30 portIrDA.setFlowControlMode(SerialPort.FLOWCONTROL_RTSCCTS_IN +
            SerialPort.FLOWCONTROL_RTSCCTS_OUT);

            // Set buffer sizes.
            portIrDA.setInputBufferSize(8192);
35             portIrDA.setOutputBufferSize(8192);
        }

        // If a COM port for Bluetooth was specified open it.
        if(portNameBluetooth != null)
40         {
            addToExecutionLog("Opening Bluetooth port " + portNameBluetooth
            + "...");

            // Get port identifier and open the COM port for Bluetooth.
45             portId = CommPortIdentifier.getPortIdentifier(portNameBluetooth);

```

```

        portBluetooth = (SerialPort)portId.open("Mobile Service link
Bluetooth Port", 2000);

        // Parametrize COM port.
5        portBluetooth.setSerialPortParams(9600, SerialPort.DATABITS_8,
SerialPort.STOPBITS_1, SerialPort.PARITY_NONE);

        // Set flow control mode.

10    portBluetooth.setFlowControlMode(SerialPort.FLOWCONTROL_RTSCCTS
_IN + SerialPort.FLOWCONTROL_RTSCCTS_OUT);

        // Set buffer sizes.
        portBluetooth.setInputBufferSize(8192);
15        portBluetooth.setOutputBufferSize(8192);
    }

    // Wait for an incoming connection.
    addToExecutionLog("Scanning for devices in range...");
20    startTime = System.currentTimeMillis();
    while(System.currentTimeMillis() <= startTime + (connectionTimeout
* 1000))
    {
        if(portIrDA != null && portIrDA.isCTS())
25        {
            addToExecutionLog("Establishing IrDA connection on " +
portNameIrDA + "...");
            inputStream = portIrDA.getInputStream();
            outputStream = portIrDA.getOutputStream();
30            break;
        }

        // On incoming connection on Bluetooth port link I/O streams to the
same.
35        if(portBluetooth != null && portBluetooth.isCTS())
        {
            addToExecutionLog("Establishing Bluetooth connection on " +
portNameBluetooth + "...");
            inputStream = portBluetooth.getInputStream();
40            outputStream = portBluetooth.getOutputStream();
            break;
        }

        Thread.sleep(500);
45    }

```

```

// If we got connected then execute the communication handler.
if(inputStream != null && outputStream != null)
{
    addToExecutionLog("Connection established...");
5
    // Create and start phone module.
    phoneModule = new PhoneModule(this);
    phoneModule.handleCommunication();
    phoneModule = null;
10
    // Close the streams.
    inputStream.close();
    outputStream.close();

    addToExecutionLog("Connection terminated...");
15
}
else
{
    addToExecutionLog("No devices were found...");
20
}

// Close the COM ports.
if(portIrDA != null)
{
25
    addToExecutionLog("Closing IrDA port " + portNameIrDA + "...");
    portIrDA.close();
    portIrDA = null;
}

30
if(portBluetooth != null)
{
    addToExecutionLog("Closing Bluetooth port " + portNameBluetooth
+ "...");
    portBluetooth.close();
35
    portBluetooth = null;
}
}

catch(NoSuchPortException e) { addToExecutionLog("Error: the
40
configured COM port doesn't exist!"); }
catch(PortInUseException e) { addToExecutionLog("Error: the
configured COM port is already in use!"); }
catch(UnsupportedCommOperationException e) {
addToExecutionLog("Error: a problem occurred with the COM port!"); }
45
catch(IOException e) { addToExecutionLog("Error: a problem occurred
with the COM port!"); }

```

```

        catch(InterruptedException e) { addToExecutionLog("Error: sleep was
interrupted!"); }
    }

```

5

```

    /**
     * This plays the specified video.
     */

```

```

    public void playVideo(String fileName)
    {
        if(mobileServiceLinkMode != modeController)

```

10

```

        {
            // The temporary video player needed to guarantee clean switching.
            Player _videoPlayer = null;

```

15

```

            // The temporary video component needed to guarantee clean
switching.
            Component _videoComponent = null;

```

20

```

            addToExecutionLog("Playing video sequence: " + fileName);

```

```

            // In case another video is still running: stop it.

```

```

            if(videoPlayer != null)

```

25

```

            {
                videoPlayer.stop();
            }

```

```

            try

```

30

```

            {
                // Create a temporary video player for the specified file.
                _videoPlayer = Manager.createRealizedPlayer(new
MediaLocator("file:" + fileName));

```

35

```

                // Get the temporary visual component for the video player.
                _videoComponent = _videoPlayer.getVisualComponent();

```

```

                // Add the video to our window at the top level.

```

```

                videoPlayerPanel.add(_videoComponent, 0);

```

40

```

                // Position and size the video.

```

```

                _videoComponent.setBounds(10, 20, videoWidth, videoHeight);

```

```

                // Start playing.

```

45

```

                _videoPlayer.start();
            }

```



```

        // Activate the last element in the list in order to ensure that the current
        message is always displayed.
        executionLog.select(executionLog.getItemCount()-1);
5      }
      }

  /**
   * This loads the product list from the file PRODUCTS.TXT:
10   *
   * <Name>
   * <Price>
   * <VendProdID>
   * <Selection Animation>
15   * <Confirmation Yes Animation>
   * <Confirmation No Animation>
   * <Delivery Animation>
   * <Highlighting Picture>
   * <Highlighting Picture x coordinate>
20   * <Highlighting Picture y coordinate>
   * <Highlighting Picture width>
   * <Highlighting Picture height>
   *
   * In order to modify the product list, the controller software needs to be
25 restarted.
   */
   private boolean loadProductList()
   {
30     try
     {
       // Open the file, read it into a buffer and convert it to a string.
       FileReader fileReader = new FileReader("products.txt");
       char[] buffer = new char[64*1024];
       fileReader.read(buffer);
35       fileReader.close();
       String string = String.valueOf(buffer);

       // Create a string tokenizer to easily access the tokens, separated by
       commas and carriage returns.
40       StringTokenizer stringTokenizer = new StringTokenizer(string, ",\n\r",
       false);

       // Construct the product list.
       while(stringTokenizer.countTokens() >= 13)
45       {

```





```

*/

import java.io.*;
import java.util.*;
5  import javax.comm.*;

public class PhoneModule
{
10  // Communication timeouts.
    private final long replyTimeout    = 15;
    private final long selectionTimeout = 300;

    // Mobile Service Link compatible phones.
15  private final int nonCompatiblePhone = 0;
    private final int ericssonR320s    = 1;
    private final int ericssonR520m    = 2;
    private final int ericssonT28s     = 3;

20  // State machine states.
    private final int stateExit                = -1;
    private final int stateInitializeConnection = 0;
    private final int stateCheckVPLList       = 1;
    private final int stateGetPhoneModel      = 2;
25  private final int stateGetQpassMemberID    = 3;
    private final int stateSendWelcomeMessageBox = 4;
    private final int stateSendInitialVendorMenu = 5;
    private final int stateWaitForUserToActivateVendorMenu = 6;
    private final int stateSendAuthenticationRequest = 7;
30  private final int stateWaitForUserToEnterPassword = 8;
    private final int stateAuthenticate          = 9;
    private final int stateAuthenticationFailed   = 10;
    private final int stateSendProductList       = 11;
    private final int stateWaitForUserToSelectProduct = 12;
35  private final int stateSendConfirmationDialog = 13;
    private final int stateWaitForUserToConfirmPurchase = 14;
    private final int stateProcessTransaction     = 15;
    private final int stateTransactionFailed      = 16;
    private final int stateSendAnotherPurchaseDialog = 17;
40  private final int stateWaitForUserToExit      = 18;
    private final int stateSendThankYouMessageBox = 19;

    // General phone commands that will work on all mobile phones that have
    a modem.
45  private final String phoneGetManufacturerIdentification = "AT+CGMI";
    private final String phoneGetModelIdentification       = "AT+CGMM";

```

```

private final String phoneGetRevisionIdentification = "AT+CGRI";
private final String phoneGetSerialNumber = "AT+CGSN";
private final String phoneGetPhoneNumber = "AT+CNUM";

```

```

5 // The following lines contain generic data for illustrative purposes. The
  actual
  // commands used are proprietary information of Ericsson and are
  // available to a user through an agreement with Ericsson.

10 // Ericsson commands.
  private final String ericssonAddAccessoryMenu = "XXXXXX=";
  private final String ericssonAddAccessorySubMenu = "XXXXXX=";
  private final String ericssonAccessoryInputDialog = "XXXXXX=";

15 // Ericsson result codes.
  private final String ericssonAccessoryAdditionalIndication = "**XXXX";
  private final String ericssonAccessoryInputDialogIdentification = "**XXXX";

  // End of Ericsson proprietary information.

20 // Mobile Service Link specific commands.
  private final String phoneWelcomeMessage =
  ericssonAccessoryInputDialog + "1,6,\"Wanna phone a drink?\",50";
  private final String phoneMainMenu =
25 ericssonAddAccessoryMenu + "\"Gold Dust\"";
  private final String phoneAuthenticationMessage =
  ericssonAccessoryInputDialog + "1,1,\"Authentication in progress...\"";
  private final String phoneAuthenticationFailedMessage =
  ericssonAccessoryInputDialog + "1,1,\"Authentication failed!\"";
30 private final String phoneProductList =
  ericssonAccessoryInputDialog + "5,1,\"Select Product\",1,";
  private final String phoneLoginDialog =
  ericssonAccessoryInputDialog + "12,1,\"Qpass Login\", \"Enter
  password:\",5";
35 private final String phoneBuyNowDialog =
  ericssonAccessoryInputDialog + "2,1,";
  private final String phoneProcessTransactionMessage =
  ericssonAccessoryInputDialog + "1,1,\"Processing transaction...\"";
  private final String phoneTransactionFailedMessage =
40 ericssonAccessoryInputDialog + "1,6,\"Transaction failed!\"";
  private final String phoneBuyAnotherItemDialog =
  ericssonAccessoryInputDialog + "2,1,\"Buy another item?\"";
  private final String phoneThankYouMessage =
  ericssonAccessoryInputDialog + "1,6,\"Thank you for using Qpass!\"";
45 // Mobile Service Link specific result codes.

```

```

    private final String phoneProductSelection =
ericssonAccessoryInputDialogIdentification + "5,";

    // Phone model (may be used in case commands vary between different
5   models).
    private int handsetModel = nonCompatiblePhone;

    // Session information.
    private int selectedProduct = 0;
10   private String QpassMemberID = "";
    private String QpassPassword = "";

    // Qpass authentication and transaction results;
    private QpassLogonResult logonResult;
15   private QpassPurchaseResult purchaseResult;

    // Reference to the MobileServiceLink instance (main application).
    private MobileServiceLink mobileServiceLink;

20
    /**
     * Constructor.
     */
    public PhoneModule(MobileServiceLink mobileServiceLink)
25   {
        // Store reference to main application.
        this.mobileServiceLink = mobileServiceLink;
    }

30
    /**
     * This is the communication handler that talks to the phone.
     */
    public void handleCommunication()
35   {
        // Set state machine to its initial state.
        int state = stateInitializeConnection;

        try
40   {
            // If run in simulation mode only simulate the good case...
            if(mobileServiceLink.mobileServiceLinkMode ==
mobileServiceLink.modeSimulation)
            {
45   {
                if(mobileServiceLink.QpassMemberIDOverride == null)
                {

```

```

        QpassMemberID = "GoldDust";
    }
    else
    {
5       QpassMemberID = mobileServiceLink.QpassMemberIDOverride;
    }

    if(mobileServiceLink.QpassPasswordOverride == null)
    {
10      QpassPassword = "GoldDust";
    }
    else
    {
15      QpassPassword = mobileServiceLink.QpassPasswordOverride;
    }

    resetProductsHighlightingStatus();
    mobileServiceLink.addToExecutionLog("Scanning for phones in
range...");
20    Thread.sleep(5000);

    mobileServiceLink.pictureHighlighter.setHighlightStatus(true, true,
false, false, false);
    mobileServiceLink.addToExecutionLog("Connection established...");
25    Thread.sleep(2000);

    mobileServiceLink.pictureHighlighter.setHighlightStatus(false, true,
false, false, false);
    mobileServiceLink.addToExecutionLog("Identified Mobile Service
30    Link compatible phone...");

    mobileServiceLink.playVideo(mobileServiceLink.videoPhoneInRange);
    Thread.sleep(3000);

35    mobileServiceLink.pictureHighlighter.setHighlightStatus(false, true,
true, false, false);
    mobileServiceLink.addToExecutionLog("Retrieved Qpass Member
ID: " + QpassMemberID);
    Thread.sleep(2000);
40

    mobileServiceLink.pictureHighlighter.setHighlightStatus(false, true,
false, false, false);
    mobileServiceLink.addToExecutionLog("Mobile Service Link menu
added...");
45    Thread.sleep(5000);

```



```

        logonResult =
QpassEngineProxyOfflineSimulator.authenticateUser("GoldDust", "13975",
mobileServiceLink.QpassVendorID);
    }
5
    if(logonResult.getResult())
    {
        mobileServiceLink.addToExecutionLog("User authentication
succeeded...");
10
        mobileServiceLink.playVideo(mobileServiceLink.videoAuthenticationSucce
eded);
    }
    else
15
    {
        mobileServiceLink.addToExecutionLog("User authentication failed: "
+ logonResult.getErrorReason() + "...");

        mobileServiceLink.playVideo(mobileServiceLink.videoAuthenticationFailed
20
        );
    }

    mobileServiceLink.pictureHighlighter.setHighlightStatus(false, false,
false, true, true);
25
    Thread.sleep(1000);

    mobileServiceLink.pictureHighlighter.setHighlightStatus(false, true,
false, false, false);
    mobileServiceLink.addToExecutionLog("Product list sent...");
30
    Thread.sleep(5000);

    mobileServiceLink.pictureHighlighter.setHighlightStatus(false, false,
true, false, false);
    selectedProduct = Math.max(new Random().nextInt(6), 1);
35

    ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
1)).setHighlightingStatus(true);
    mobileServiceLink.addToExecutionLog("User selected product: " +
    ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
40
    1)).getName());

    mobileServiceLink.playVideo(((Product)mobileServiceLink.getProductList()
.elementAt(selectedProduct-1)).getSelectionFileName());
    Thread.sleep(5000);
45

```

```

        mobileServiceLink.pictureHighlighter.setHighlightStatus(false, false,
true, false, false);
        String name =
        ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
5      1)).getName();
        float price =
        ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
1      1)).getPrice();
        mobileServiceLink.addToExecutionLog("Confirmation requested...");
10      Thread.sleep(4000);

        mobileServiceLink.pictureHighlighter.setHighlightStatus(false, true,
false, false, false);
        mobileServiceLink.addToExecutionLog("User confirmed purchase");
15      mobileServiceLink.playVideo(((Product)mobileServiceLink.getProductList()
        .elementAt(selectedProduct-1)).getConfirmationYesFileName());
        Thread.sleep(1000);

20      mobileServiceLink.pictureHighlighter.setHighlightStatus(false, false,
false, true, false);
        mobileServiceLink.addToExecutionLog("Transaction processing
message displayed...");
        String vendProdID =
25      ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
1)).getVendProdID();
        mobileServiceLink.addToExecutionLog("Processing purchase of 1 " +
name + " (" + vendProdID + ") at " + price + "0");

30      // If the -offline switch was not set then do the transaction with the
Mobile Service Link demo account live...
        if(!mobileServiceLink.offlineMode)
        {
            purchaseResult =
35      QpassEngineProxy.processPurchase(logonResult.getSessionCookie(),
mobileServiceLink.QpassVendorID, vendProdID);
        }
        // ...otherwise just simulate it.
        else
40      {
            purchaseResult =
            QpassEngineProxyOfflineSimulator.processPurchase(logonResult.getSes
            sionCookie(), mobileServiceLink.QpassVendorID, vendProdID);
        }
45      if(purchaseResult.getResult())

```

```

        {
            mobileServiceLink.pictureHighlighter.setHighlightStatus(false, false,
false, true, true);
            Thread.sleep(1000);
5            mobileServiceLink.addToExecutionLog("Transaction succeeded...");
            mobileServiceLink.pictureHighlighter.setHighlightStatus(true, true,
false, false, false);

            mobileServiceLink.vendingMachineModule.deliverProduct(selectedProduc
10 t);
        }
        else
        {
            mobileServiceLink.addToExecutionLog("Transaction failed: " +
15 purchaseResult.getErrorReason() + "...");
        }

        Thread.sleep(10000);

20        mobileServiceLink.pictureHighlighter.setHighlightStatus(false, false,
true, false, false);
        mobileServiceLink.addToExecutionLog("User is done...");
        Thread.sleep(1000);

25        mobileServiceLink.pictureHighlighter.setHighlightStatus(false, true,
false, false, false);
        mobileServiceLink.addToExecutionLog("Displayed thank you
message...");

30        mobileServiceLink.playVideo(mobileServiceLink.videoAnotherItemNo);
        Thread.sleep(10000);
    }
    // ...otherwise do the live demo.
    else
35    {
        while(state != stateExit)
        {
            switch(state)
            {
40                case stateInitializeConnection:
                {
                    mobileServiceLink.addToExecutionLog("Initializing
connection...");

45                    // Reset the authentication information from previous transactions.
                    QpassMemberID = "";

```



```

        QpassPassword = "";

        // Reset highlighting.
        resetProductsHighlightingStatus();
5        mobileServiceLink.pictureHighlighter.setHighlightStatus(true, true,
false, false, false);

        // Playback video sequence.

10    mobileServiceLink.playVideo(mobileServiceLink.videoPhoneInRange);

        state = stateCheckVIPList;
        break;
    }

15    case stateCheckVIPList:
    {
        int nextState = stateGetPhoneModel;

20        // Request the phone's serial number as VIP identifier.
        String serialNumber =
sendPhoneCommand(phoneGetSerialNumber);

        // Get the VIP list.
25        Vector vipList = mobileServiceLink.getVIPList();

        // Get an iterator to the VIP list.
        Iterator iterator = vipList.iterator();

30        // Step over all VIPs.
        while(iterator.hasNext())
        {
            // Get the next VIP.
            VIP vip = (VIP)iterator.next();

35            // Compare the VIP's phone serial number with the one received.
            if(serialNumber.indexOf(vip.getSerialNumber()) != -1)
            {
                // Deliver the product, log the transaction and deduct the cost
40                from the VIP user's prepaid account.
                Product product =
(Product)mobileServiceLink.getProductList().elementAt(vip.getPreferredPr
oductNumber()-1);
                if((vip.getPrepaidAccount() >= product.getCost()) ||
45                (vip.getPrepaidAccount() == -1))
                {

```

```

        // Deliver the product and log the transaction.
        mobileServiceLink.addToExecutionLog("Welcome " +
vip.getName() + ", here's your " + product.getName() + "...");

5    mobileServiceLink.vendingMachineModule.deliverProduct(vip.getPreferre
dProductNumber());
        TransactionLog.logTransaction(vip.getName(),
product.getName());

10        // Only deduct the cost from the VIP's account if he isn't
allowed for free drinks.
        if(vip.getPrepaidAccount() != -1)
        {
            // Only charge the actual product cost to the VIP user's
15    prepaid account and save the status.
            vip.setPrepaidAccount(vip.getPrepaidAccount() -
product.getCost());
            mobileServiceLink.setVIPList(vipList);
        }
20        }
        else
        {
            mobileServiceLink.addToExecutionLog("Sorry " +
vip.getName() + ", but your prepaid account has an insufficient
25    balance...");
        }
        nextState = stateInitializeConnection;
    }
}
30    state = nextState;
    break;
}

35    case stateGetPhoneModel:
    {
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
true, false, false, false);

40    if(sendPhoneCommand(phoneGetManufacturerIdentification).indexOf("ER
ICSSON") != -1)
        {
            String phoneModel =
sendPhoneCommand(phoneGetModelIdentification);
45            if(phoneModel.indexOf("R320s") != -1)

```

```

        {
            handsetModel = ericssonR320s;
        }
        else if(phoneModel.indexOf("R520m") != -1)
5         {
            handsetModel = ericssonR520m;
        }
        else if(phoneModel.indexOf("T28s") != -1)
10        {
            handsetModel = ericssonT28s;
        }
        else
        {
            handsetModel = nonCompatiblePhone;
15        }
        // More models to follow here...
    }

    if(handsetModel != nonCompatiblePhone)
20    {
        mobileServiceLink.addToExecutionLog("Identified Mobile
Service Link compatible phone...");
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
true, true, false, false);
25        state = stateGetQpassMemberID;
    }
    else
    {
        mobileServiceLink.addToExecutionLog("The device in range is
30 not a Mobile Service Link compatible phone...");
        state = stateInitializeConnection;
    }
    break;
}
35

case stateGetQpassMemberID:
{
    // We use the phone's unique serial number as Member ID for our
40 Qpass account. This provides additional security
    // since you need to physically possess the phone. It also helps to
avoid unnecessary typing.
    String serialNumber =
sendPhoneCommand(phoneGetSerialNumber);
45    if(serialNumber.indexOf("ERROR") == -1)
    {

```

```

        if(mobileServiceLink.QpassMemberIDOverride == null)
        {
            QpassMemberID = (serialNumber.substring(0,
5            serialNumber.indexOf("OK"))).trim();
        }
        else
        {
            QpassMemberID =
10        mobileServiceLink.QpassMemberIDOverride;
        }
        mobileServiceLink.addToExecutionLog("Retrieved Qpass
        Member ID: " + QpassMemberID);
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
        true, true, false, false);
15        state = stateSendWelcomeMessageBox;
    }
    else
    {
        mobileServiceLink.addToExecutionLog("Couldn't read phone's
20        serial number...");
        state = stateInitializeConnection;
    }
    break;
}

25

        case stateSendWelcomeMessageBox:
        {
            if(sendPhoneCommand(phoneWelcomeMessage).indexOf("OK")
30        != -1)
            {
                // Display message.
                mobileServiceLink.addToExecutionLog("Displayed welcome
                message...");
35                if(!receivePhoneAnswer(selectionTimeout).endsWith("0"))
                {
                    mobileServiceLink.addToExecutionLog("Couldn't display
                    welcome message - exiting...");
40                    state = stateInitializeConnection;
                }
                state = stateSendInitialVendorMenu;
            }
            else
45        {

```

```

        mobileServiceLink.addToExecutionLog("Couldn't display
welcome message - exiting...");
        state = stateInitializeConnection;
    }
5    break;
}

    case stateSendInitialVendorMenu:
10    {
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
true, false, false, false);
        if(sendPhoneCommand(phoneMainMenu).indexOf("OK") != -1)
        {
15            mobileServiceLink.addToExecutionLog("Mobile Service Link
menu added...");
            mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
false, true, false, false);
            state = stateWaitForUserToActivateVendorMenu;
20        }
        else
        {
            mobileServiceLink.addToExecutionLog("Couldn't add Mobile
Service Link menu...");
25            state = stateInitializeConnection;
        }
        break;
    }

    case stateWaitForUserToActivateVendorMenu:
30    {

        if(receivePhoneAnswer(selectionTimeout).indexOf(ericssonAccessoryAddi
tionalIndication) != -1)
35        {
            mobileServiceLink.addToExecutionLog("Mobile Service Link
menu selected...");
            mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
true, true, false, false);
40            mobileServiceLink.playVideo(mobileServiceLink.videoActivateVendorMen
u);
            state = stateSendAuthenticationRequest;
        }
45        else
        {

```

```

        mobileServiceLink.addToExecutionLog("Phone returned
undefined selection...");
        state = stateInitializeConnection;
    }
5    break;
}

    case stateSendAuthenticationRequest:
    {
10        if(sendPhoneCommand(phoneLoginDialog).indexOf("OK") != -1)
        {
            mobileServiceLink.addToExecutionLog("Authentication
requested...");
            mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
15            true, false, false, false);
            state = stateWaitForUserToEnterPassword;
        }
        else
        {
20            mobileServiceLink.addToExecutionLog("Couldn't add
authentication dialog...");
            state = stateInitializeConnection;
        }
        break;
25    }

    case stateWaitForUserToEnterPassword:
    {
30        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
true, true, false, false);
        String selection = receivePhoneAnswer(selectionTimeout);
        if(selection.indexOf(ericssonAccessoryInputDialogIdentification)
!= -1)
35        {
            if(selection.indexOf(ericssonAccessoryInputDialogIdentification
+ ": 0") != -1)
            {
                mobileServiceLink.addToExecutionLog("User aborted
40 authentication");
                state = stateWaitForUserToActivateVendorMenu;
            }
            else
            {
45                if(mobileServiceLink.QpassPasswordOverride == null)
                {

```

```

        QpassPassword =
selection.substring(selection.indexOf("\\")+1, selection.indexOf("\\")+1+5);
    }
    else
5      {
        QpassPassword =
mobileServiceLink.QpassPasswordOverride;
    }
    mobileServiceLink.addToExecutionLog("User entered
10 password: " + QpassPassword);

mobileServiceLink.playVideo(mobileServiceLink.videoEnterPassword);
    state = stateAuthenticate;
    }
15    }
    else
    {
        mobileServiceLink.addToExecutionLog("Phone returned
undefined answer...");
20    state = stateInitializeConnection;
    }
    break;
    }

25    case stateAuthenticate:
    {

if(sendPhoneCommand(phoneAuthenticationMessage).indexOf("OK") != -
30    1)
    {
        mobileServiceLink.addToExecutionLog("Authentication
message displayed...");
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
false, true, false, false);
35
        mobileServiceLink.addToExecutionLog("Authentication in
progress...");
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
false, false, true, true);
40

        // If the -offline switch was not set then do the authentication with
the selected account live...
        if(!mobileServiceLink.offlineMode)
        {

```

```

        logonResult =
QpassEngineProxy.authenticateUser(QpassMemberID, QpassPassword,
mobileServiceLink.QpassVendorID);
    }
5        // ...otherwise just simulate it.
        else
        {
            logonResult =
QpassEngineProxyOfflineSimulator.authenticateUser(QpassMemberID,
10 QpassPassword, mobileServiceLink.QpassVendorID);
        }

        if(logonResult.getResult())
        {
15            mobileServiceLink.addToExecutionLog("User authentication
succeeded...");

            mobileServiceLink.playVideo(mobileServiceLink.videoAuthenticationSucce
eded);
20            state = stateSendProductList;
        }
        else
        {
            mobileServiceLink.addToExecutionLog("User authentication
25 failed: " + logonResult.getErrorReason() + "...");

            mobileServiceLink.playVideo(mobileServiceLink.videoAuthenticationFailed
);
            state = stateAuthenticationFailed;
30        }
        }
        else
        {
            mobileServiceLink.addToExecutionLog("Couldn't add
35 authentication dialog...");
            state = stateInitializeConnection;
        }
        break;
    }
40

    case stateAuthenticationFailed:
    {
45        if(sendPhoneCommand(phoneAuthenticationFailedMessage).indexOf("OK
") != -1)

```



```

        {
            mobileServiceLink.addToExecutionLog("Authentication failure
message displayed...");
            Thread.sleep(2000);
5             state = stateSendAuthenticationRequest;
        }
        else
        {
            mobileServiceLink.addToExecutionLog("Couldn't add
10 authentication dialog...");
            state = stateInitializeConnection;
        }
        break;
    }

15     case stateSendProductList:
    {
        resetProductsHighlightingStatus();
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
20 true, false, false, false);
        if(sendPhoneCommand(createPhoneProductList()).indexOf("OK")
        != -1)
        {
            mobileServiceLink.addToExecutionLog("Product list sent...");
25             state = stateWaitForUserToSelectProduct;
        }
        else
        {
            mobileServiceLink.addToExecutionLog("Couldn't send product
30 list...");
            state = stateInitializeConnection;
        }
        break;
    }

35     case stateWaitForUserToSelectProduct:
    {
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
false, true, false, false);
40         String selection = receivePhoneAnswer(selectionTimeout);
        if(selection.indexOf(ericssonAccessoryInputDialogIdentification)
        != -1)
        {
            if(selection.indexOf(ericssonAccessoryInputDialogIdentification
45 + ": 0") != -1)
            {

```

```

        mobileServiceLink.addToExecutionLog("User aborted product
selection");
        state = stateWaitForUserToActivateVendorMenu;
    }
5    else
    {
        selectedProduct = (new
Integer(selection.substring(selection.indexOf(",")+1))).intValue();
10    ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
1)).setHighlightingStatus(true);
        mobileServiceLink.addToExecutionLog("User selected product:
" +
15    ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
1)).getName());

        mobileServiceLink.playVideo(((Product)mobileServiceLink.getProductList()
.elementAt(selectedProduct-1)).getSelectionFileName());
        state = stateSendConfirmationDialog;
20    }
    }
    else
    {
        mobileServiceLink.addToExecutionLog("Phone returned
25    undefined answer...");
        state = stateInitializeConnection;
    }
    break;
}

30    case stateSendConfirmationDialog:
    {
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
false, true, false, false);
35    String name =
        ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
1)).getName();
        float price =
40    ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
1)).getPrice();

        if(sendPhoneCommand(createConfirmationDialog(name,
45    price)).indexOf("OK") != -1)
        {

```

```

        mobileServiceLink.addToExecutionLog("Confirmation
requested...");
        state = stateWaitForUserToConfirmPurchase;
    }
5    else
    {
        mobileServiceLink.addToExecutionLog("Couldn't add
confirmation dialog...");
        state = stateInitializeConnection;
10    }
    break;
}

15    case stateWaitForUserToConfirmPurchase:
    {
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
true, false, false, false);
        String selection = receivePhoneAnswer(selectionTimeout);
20        if(selection.indexOf(ericssonAccessoryInputDialogIdentification)
!= -1)
        {
            // User selected "No".
            if(selection.endsWith("0"))
25            {
                mobileServiceLink.addToExecutionLog("User aborted
confirmation dialog");

                mobileServiceLink.playVideo(((Product)mobileServiceLink.getProductList()
30                .elementAt(selectedProduct-1)).getConfirmationNoFileName());
                state = stateSendProductList;
            }
            // User selected "Yes".
            else
35            {
                mobileServiceLink.addToExecutionLog("User confirmed
purchase");

                mobileServiceLink.playVideo(((Product)mobileServiceLink.getProductList()
40                .elementAt(selectedProduct-1)).getConfirmationYesFileName());
                state = stateProcessTransaction;
            }
        }
    }
    else
45    {

```

```

        mobileServiceLink.addToExecutionLog("Phone returned
undefined answer...");
        state = stateInitializeConnection;
    }
5    break;
}

    case stateProcessTransaction:
    {
10    if(sendPhoneCommand(phoneProcessTransactionMessage).indexOf("OK"
    ) != -1)
        {
            mobileServiceLink.addToExecutionLog("Transaction processing
15    message displayed...");
            mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
            false, false, true, false);

            String name    =
20    ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
            1)).getName();
            float price    =
            ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
            1)).getPrice();
25    String vendProdID =
            ((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
            1)).getVendProdID();

            mobileServiceLink.addToExecutionLog("Processing purchase of
30    1 " + name + " (" + vendProdID + ") at " + price + "0");
            mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
            false, false, true, true);

            // If the -offline switch was not set then do the transaction with
35    the selected account live...
            if(!mobileServiceLink.offlineMode)
            {
                purchaseResult =
                QpassEngineProxy.processPurchase(logonResult.getSessionCookie(),
40    mobileServiceLink.QpassVendorID, vendProdID);
            }
            // ...otherwise just simulate it.
            else
            {

```

```

        purchaseResult =
QpassEngineProxyOfflineSimulator.processPurchase(logonResult.getSes
sionCookie(), mobileServiceLink.QpassVendorID, vendProdID);
    }
5
    if(purchaseResult.getResult())
    {
        mobileServiceLink.addToExecutionLog("Transaction
succeeded...");
10        mobileServiceLink.pictureHighlighter.setHighlightStatus(true,
true, false, false, false);

        mobileServiceLink.vendingMachineModule.deliverProduct(selectedProduc
t);
15        TransactionLog.logTransaction("Workshop",
((Product)mobileServiceLink.getProductList().elementAt(selectedProduct-
1)).getName());
        state = stateSendAnotherPurchaseDialog;
    }
20    else
    {
        mobileServiceLink.addToExecutionLog("Transaction failed: " +
purchaseResult.getErrorReason() + "...");
        state = stateTransactionFailed;
25    }
    }
    else
    {
        mobileServiceLink.addToExecutionLog("Couldn't display
30 transaction processing message...");
        state = stateInitializeConnection;
    }
    break;
}
35

    case stateTransactionFailed:
    {
40    if(sendPhoneCommand(phoneTransactionFailedMessage).indexOf("OK")
!= -1)
        {
            mobileServiceLink.addToExecutionLog("Transaction failure
message displayed...");
45            Thread.sleep(2000);
            state = stateInitializeConnection;
        }
    }
}

```

```

    }
    else
    {
        mobileServiceLink.addToExecutionLog("Couldn't add
5 authentication dialog...");
        state = stateInitializeConnection;
    }
    break;
}
10
    case stateSendAnotherPurchaseDialog:
    {
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
        true, false, false, false);
15
        if(sendPhoneCommand(phoneBuyAnotherItemDialog).indexOf("OK") != -
        1)
        {
            mobileServiceLink.addToExecutionLog("Another purchase
20 requested...");
            state = stateWaitForUserToExit;
        }
        else
        {
            mobileServiceLink.addToExecutionLog("Couldn't add another
25 purchase dialog...");
            state = stateInitializeConnection;
        }
        break;
30
    }

    case stateWaitForUserToExit:
    {
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
35 false, true, false, false);
        String selection = receivePhoneAnswer(selectionTimeout);
        if(selection.indexOf(ericssonAccessoryInputDialogIdentification)
        != -1)
        {
40
            // User selected "No".
            if(selection.endsWith("0"))
            {
                mobileServiceLink.addToExecutionLog("User is done...");
45
                mobileServiceLink.playVideo(mobileServiceLink.videoAnotherItemNo);
                state = stateSendThankYouMessageBox;
            }
        }
    }
}

```

```

        }
        // User selected "Yes".
        else
        {
5          mobileServiceLink.addToExecutionLog("User wants to buy
another item...");

        mobileServiceLink.playVideo(mobileServiceLink.videoAnotherItemYes);
        state = stateSendProductList;
10      }
    }
    else
    {
        mobileServiceLink.addToExecutionLog("Phone returned
15 undefined answer...");
        state = stateInitializeConnection;
    }
    break;
}

20

    case stateSendThankYouMessageBox:
    {
        mobileServiceLink.pictureHighlighter.setHighlightStatus(false,
25 true, false, false, false);
        if(sendPhoneCommand(phoneThankYouMessage).indexOf("OK")
!= -1)
        {
            // Display message.
30          mobileServiceLink.addToExecutionLog("Displayed thank you
message...");
            state = stateExit;
        }
        else
35      {
            mobileServiceLink.addToExecutionLog("Couldn't display thank
you message - exiting...");
            state = stateExit;
        }
40      break;
    }
}
}
}
45 }

```

```

        catch(StringIndexOutOfBoundsException e) {
mobileServiceLink.addToExecutionLog("Error: Lost connection to
phone!"); }
        catch(InterruptedException e) {
5 mobileServiceLink.addToExecutionLog("Error: sleep was interrupted!"); }
    }

    /**
10    * This returns what is received from the phone or times out.
    */
    private String receivePhoneAnswer(long timeout)
    {
        int readCount;
15        String answer = "";
        long startingTime = System.currentTimeMillis();

        try
        {
20            // Wait for phone to talk.
            while(System.currentTimeMillis() < startingTime + (timeout * 1000) &&
mobileServiceLink.inputStream.available() == 0)
            {
                // In case the phone is not so fast give it a second to relax.
25                Thread.sleep(1000);
            }

            // Read characters from input stream until it is empty.
            if((readCount = mobileServiceLink.inputStream.available()) > 0)
30            {
                byte[] byteArray = new byte[readCount];
                char[] charArray = new char[readCount];

                // Get data from input stream.
35                mobileServiceLink.inputStream.read(byteArray);

                // Convert it to a character array...
                for(int i=0; i<readCount; i++) charArray[i] = (char)byteArray[i];

                // ...and subsequently to a string.
40                answer = String.valueOf(charArray);
            }
        }
        catch(IOException e) {
45        mobileServiceLink.addToExecutionLog("Communication error with
phone..."); }
    }

```



```

        catch(InterruptedException e) {}

        return answer.trim();
    }
5

    /**
     * This sends out a string and receives the phone's answer or times out.
     */
10 private String sendPhoneCommand(String command)
    {
        String answer = "";

        try
15     {
            // Send terminated command.
            mobileServiceLink.outputStream.write((command+"\r").getBytes());
            mobileServiceLink.outputStream.flush();
        }
20     catch(IOException e) {
        mobileServiceLink.addToExecutionLog("Communication error with
        phone..."); }

        // Get phone's answer.
25     answer = receivePhoneAnswer(replyTimeout);

        // Return answer with eliminated echo.
        return answer.substring(0, answer.indexOf(command)) +
        answer.substring(answer.indexOf(command) + command.length());
30     }

    /**
     * This dynamically creates the product list command for the phone.
     */
35 private String createPhoneProductList()
    {
        // Initiate the string with the basic command.
        String string = phoneProductList;

40     // Add the number of products to it.
        string += string.valueOf(mobileServiceLink.getProductList().size()) + ",";

        // Get an iterator to the product list.
        Iterator iterator = mobileServiceLink.getProductList().iterator();
45

        // Step over all products.

```

```

while(iterator.hasNext())
{
    // Get the next product.
    Product product = (Product)iterator.next();

    // Add the products name in quotes to the product list.
    string += "\"" + product.getName() + "\"";

    // Add a comma for all but the last product.
    if(iterator.hasNext())
    {
        string += ",";
    }

    return string;
}

/**
 * This dynamically creates the confirmation dialog command for the
 * phone.
 */
private String createConfirmationDialog(String name, float price)
{
    return phoneBuyNowDialog + "\"Buy 1 " + name + " at " + (new
Float(price)).toString().trim() + "0?\"";
}

/**
 * This resets all products to non-highlighted.
 */
private void resetProductsHighlightingStatus()
{
    // Get an iterator to the product list.
    Iterator iterator = mobileServiceLink.getProductList().iterator();

    // Step over all products.
    while(iterator.hasNext())
    {
        // Reset the next product.
        ((Product)iterator.next()).setHighlightingStatus(false);
    }
}

```

```

-----

/**
 * VendingMachineModule.java
 *
5  * (c) Copyright 2001 Accenture - all rights reserved.
 */

import java.io.*;
import java.util.*;
10 import javax.comm.*;

public class VendingMachineModule
{
    // Communication timeouts.
15    private final long replyTimeout = 5;

    // Requests the Sielaff vending machine to return the text that is currently
    // shown on the display.
    private final byte vendingMachineReadStatus[] = {(byte)0xDC};
20

    // Requests the Sielaff vending machine to deliver a drink (only works if
    // machine is set to free-of-charge mode!).
    private final byte vendingMachineDeliverProduct = (byte)0xC0;

25    // Serial port access members.
    private CommPortIdentifier portId = null;
    private SerialPort serialPort = null;

    // I/O streams for RS232 communication.
30    private InputStream inputStream;
    private OutputStream outputStream;

    // Link to the MobileServiceLink instance (main application).
    private MobileServiceLink mobileServiceLink;
35

/**
 * Constructor.
 */
public VendingMachineModule(MobileServiceLink mobileServiceLink)
40 {
    try
    {
        // Store reference to main application.
        this.mobileServiceLink = mobileServiceLink;
45

        if(mobileServiceLink.portNameSielaff != null)

```



```

        catch(IOException e) { mobileServiceLink.addToExecutionLog("Error: a
        problem occurred while communicating with the COM port!"); }
    }

5  /**
    * This causes the vending machine to release one unit of the specified
    product.
    */
    public boolean deliverProduct(int productNr)
10  {
        boolean deliveryResult;

        // In case we are in simulation mode return immediately with OK.
15  if(serialPort == null)
        {
            mobileServiceLink.addToExecutionLog("Vending machine simulated
            delivery of one " +
            ((Product)mobileServiceLink.getProductList().elementAt(productNr-
20  1)).getName() + "...");

            mobileServiceLink.playVideo(((Product)mobileServiceLink.getProductList()
            .elementAt(productNr-1)).getDeliveryFileName());
            return true;
25  }

        // Deliver drink by pressing a number from 1 - 6 that corresponds to the
        vending machine column.
        byte deliveryCommand[] = {(byte)(vendingMachineDeliverProduct +
30  productNr - 1)};
        sendVendingMachineCommand(new String(deliveryCommand));
        if(sendVendingMachineCommand(new
        String(vendingMachineReadStatus)).toUpperCase().indexOf("LEER NEUE
        WAHL") == 0)
35  {
            deliveryResult = true;
            mobileServiceLink.addToExecutionLog("Vending machine delivered
            one " +
            ((Product)mobileServiceLink.getProductList().elementAt(productNr-
40  1)).getName() + "...");

            mobileServiceLink.playVideo(((Product)mobileServiceLink.getProductList()
            .elementAt(productNr-1)).getDeliveryFileName());
        }
45  else
        {

```

```

        deliveryResult = false;
        mobileServiceLink.addToExecutionLog("Vending machine failed to
deliver one " +
5      ((Product)mobileServiceLink.getProductList().elementAt(productNr-
1)).getName() + "...");
    }

    return deliveryResult;
10  }

    /**
     * This returns what is received from the vending machine or times out.
     */
15  private String receiveVendingMachineAnswer(long timeout)
    {
        char character;
        String answer = "";
        char[] characterArray = new char[1];
20      long startingTime = System.currentTimeMillis();

        try
        {
            // Wait for vending machine to talk.
25          while(System.currentTimeMillis() < startingTime + (timeout * 1000) &&
inputStream.available() == 0)
            {
                // In case the vending machine is not so fast give it a second to relax.
                Thread.sleep(1000);
30          }

            // Read characters from input stream until it is empty.
            while(inputStream.available() != 0)
            {
35              // Get next character.
                character = (char)inputStream.read();

                // Add it to the answer (note: there's probably a nicer way to do this).
                characterArray[0] = character;
40              answer += String.valueOf(characterArray);
            }
        }
        catch(IOException e) {
            mobileServiceLink.addToExecutionLog("Communication error with
45      vending machine..."); }
        catch(InterruptedException e) {}
    }

```

```

        return answer.trim();
    }

5
    /**
     * This sends out a string and receives the vending machine's answer or
     times out.
     */
10    private String sendVendingMachineCommand(String command)
    {
        try
        {
            // Send the command to the modem.
15            outputStream.write(command.getBytes());

            // Force it to be sent.
            outputStream.flush();
        }
20        catch(IOException e) {
            mobileServiceLink.addToExecutionLog("Communication error with
            vending machine..."); }

        return receiveVendingMachineAnswer(replyTimeout).trim();
25    }
}

    /**
30    * BluetoothModule.java
    *
    * (c) Copyright 2001 Accenture - all rights reserved.
    */

35    public class BluetoothModule
    {
        /**
         * First of all make sure the external native DLL gets loaded.
40         */
        static
        {
            System.loadLibrary("BluetoothModule");
        }

45        public native boolean startDiscovery();

```

```

        public native boolean phoneInRange();
        public native boolean stopDiscovery();
    }

```

5

```

#include "stdafx.h"
#include <stdio.h>

```

10

```

#include "BluetoothModule.h"
#include "BluetoothModuleImplementation.h"

```

15

```

#include "Utils.h"
#include "BTAddress.h"
#include "BTException.h"
#include "ProfileContainer.h"
#include "SPPEventHandler.h"

```

20

```

// COM module.
CComModule _Module;

```

25

```

/*
 * Standard Windows message loop.
 */
void ProcessMessages()
{
    MSG msg;

```

30

```

    // Handle Message (if there is one).
    if(PeekMessage(&msg, NULL, 0, 0, PM_REMOVE))
    {
        TranslateMessage(&msg);
        DispatchMessage(&msg);
    }
    // Otherwise avoid burning all our CPU cycles.
    else
    {
        Sleep(100);
    }
}

```

45

```

/*

```



```

* Discovery Thread.
*/
bool BluetoothModuleImplementation::StartDiscovery()
{
5   HRESULT hr;
   CBTAddress *pAddr;
   BD_ADDR raw_addr;
   dgaDUN::IBTDUNProfilePtr pDUN;
   bool bConnectionEstablished = false;
10

   logMessage("BluetoothModuleImplementation::StartDiscovery()");

   // Open the COM library.
15   OleInitialize(NULL);

   // Initialize Bluetooth stack.
   logMessage("Connecting to Bluetooth Stack...");
   hr = m_pBluetooth.CreateInstance(dgaCOM::CLSID_Bluetooth);
20   if(SUCCEEDED(hr))
   {
       logMessage("Connecting to Bluetooth Stack successful.");

       m_pEvHandler = 0;
25       CComObject<CEventHandler>::CreateInstance(&m_pEvHandler);
       m_pEvHandler->SetDCPtr(&m_DC);
       m_pEvHandler->Connect(m_pBluetooth);
   }
   else
30   {
       logMessage("Connecting to Bluetooth Stack failed!");
       return false;
   }

35   // From here on do endless device discovery and connection...
   while(!m_pEvHandler->Closedown())
   {
       // Discover Bluetooth devices in range.
40       logMessage("Doing device discovery...");
       m_DC.EnterInquiryState();
       hr = m_pBluetooth->Inquiry(INQUIRY_LENGTH, 0);
       while(m_DC.InquiryDone() == 0) { ProcessMessages(); }

45       // Search for mobile phone and attempt to connect to its DUN
       service.

```

```

    logMessage("Searching for phones in range...");
    pAddr = m_DC.GetFirst();
    while(pAddr)
    {
5        // Cellular phone device class (see Bluetooth Specification 1.0B
Appendix VIII)
        // Major Service Class . Major Device Class . Minor Device
Class . Format Type
        if(pAddr->GetClassOfDevice() && 0x40000)
10        {
            char message[128];
            pAddr->GetAddr(raw_addr);
            sprintf(message, "Trying to connect to %s.", pAddr-
>GetAddrAsString());
15            logMessage(message);
            if(ConnectDUN(raw_addr, "DUN", "Dial-up networking"))
            {
                // Wait until the connection event is fired (it must be since
                // ConnectDUN was successful, but can be a little slow)...
20                while(!m_pEvHandler->Connected())
ProcessMessages();

                // Subsequently loop until we get disconnected again...
                while(m_pEvHandler->Connected()) ProcessMessages();
25

                // Get out of the while loop.
                break;
            }

30            // Disconnect by default (even if we were not connected at
all).
            // This is for security reasons, if due to some weird
circumstances
            // the phone hasn't previously been disconnected correctly
35 (in this
            // case a new connection would be refused on and on).
            DisconnectDUN(raw_addr, "DUN", "Dial-up networking");

40        }
        pAddr = m_DC.GetNext();
    }
}

// Shutdown.
45 StopDiscovery();

```

```

        return true;
    }

5
    /*
    * Stop discovery.
    */
    bool BluetoothModuleImplementation::StopDiscovery()
10    {
        // Do not exit the program if the inquiry / name discovery is not finished
        if(m_DC.InquiryDone() && m_DC.NameRequestDone())
        {
            m_pEvHandler->Disconnect(m_pBluetooth);
15        }

        // Close the COM library.
        OleUninitialize();

20        return true;
    }

25
    /**
    * Connect to Dial-up Networking service of specified device.
    */
    bool BluetoothModuleImplementation::ConnectDUN(BD_ADDR addr,
    const char *lsname, const char *rsname)
30    {
        HRESULT hr;
        CComBSTR l_name, r_name;
        dgaDUN::IBTDUNProfilePtr pDUN;

35        logMessage("BluetoothModuleImplementation::ConnectDUN()");

        logMessage("Getting DUN profile object...");
        hr = pDUN.GetActiveObject(dgaDUN::CLSID_BTBDUNProfile);
40        if(SUCCEEDED(hr))
        {
            logMessage("Getting DUN profile object successful.");

            logMessage("Connecting DUN profile to phone...");
45            l_name = lsname;

```

```

    r_name = rsname;

    hr = pDUN->Connect(addr, l_name.Copy(), r_name.Copy());
    if(SUCCEEDED(hr))
5      {
        logMessage("Connecting DUN profile to phone successful.");
        return true;
      }
    else
10     {
        logMessage("Connecting DUN profile to phone failed!");
      }
  }
  else
15  {
    logMessage("Getting DUN profile object failed!");
  }

  return false;
20 }

/*
25  * Disconnect from Dial-up Networking service of specified device.
  */
bool BluetoothModuleImplementation::DisconnectDUN(BD_ADDR addr,
const char *l_name, const char *r_name)
{
30   HRESULT hr;
   CComBSTR l_name, r_name;
   dgaDUN::IBTDUNProfilePtr pDUN;

35   logMessage("BluetoothModuleImplementation::DisconnectDUN()");

   logMessage("Getting DUN profile object...");
   hr = pDUN.GetActiveObject(dgaDUN::CLSID_BT_DUN_Profile);
   if(SUCCEEDED(hr))
40   {
       logMessage("Getting DUN profile object successful.");

       logMessage("Disconnecting DUN profile from phone...");

45   l_name = l_name;
       r_name = r_name;

```

```

        hr = pDUN->Disconnect((BD_ADDR *)&addr, l_name.Copy(),
r_name.Copy());
        if(SUCCEEDED(hr))
5          {
            logMessage("Disconnecting DUN profile from phone
successful.");
            return true;
          }
10         else
          {
            logMessage("Disconnecting DUN profile from phone failed!");
          }
        }
15      }

      return false;
    }

20  /*
void BluetoothModuleImplementation::MobileServiceLink(void)
{
    // General phone commands that will work on all mobile phones with
    modem.
25    const char phoneGetManufacturerIdentification[] = "AT+CGMI";
    const char phoneGetModelIdentification[] = "AT+CGMM";
    const char phoneGetSerialNumber[] = "AT+CGSN";

    // The following lines contain generic commands "XXXXXX" which are
30    // actually proprietary information of Ericsson and are available to
    // other implementers through specific contract agreements
    // with Ericsson.

    // Requests.
35    const char phoneMainMenu[] = "XXXXXX=\\"Gold Dust\\"";
    const char phoneAuthenticationMessage[] =
"XXXXXX=1,1,\\"Authentication in progress...\\"";
    const char phoneAuthenticationFailedMessage[] =
"XXXXXX=1,1,\\"Authentication failed!\\"";
40    const char phoneProductList[] = "XXXXXX=5,1,\\"Select
Product\\",1,"";
    const char phoneLoginDialog[] = "XXXXXX=12,1,\\"Qpass
Login\\",\\"Enter password:\\",5";
    const char phoneBuyNowDialog[] = "XXXXXX=2,1,";
45    const char phoneProcessTransactionMessage[] =
"XXXXXX=1,1,\\"Processing transaction...\\"";

```

```

    const char phoneTransactionFailedMessage[] =
"XXXXXX=1,6,\"Transaction failed!\";
    const char phoneBuyAnotherItemDialog[] = "XXXXXX=2,1,\"Buy
another item?\";
5    const char phoneThankYouMessage[] =
"XXXXXX=1,6,\"Thank you for using Qpass!\";
    const char phoneProductSelection[] = "*XXXXXX,";

    // State machine states.
10    const int stateInitializeConnection = 0;
    const int stateCheckVIPList = 1;
    const int stateGetPhoneModel = 2;
    const int stateGetQpassMemberID = 3;
    const int stateSendInitialVendorMenu = 4;
15    const int stateWaitForUserToActivateVendorMenu = 5;
    const int stateSendAuthenticationRequest = 6;
    const int stateWaitForUserToEnterPassword = 7;
    const int stateAuthenticate = 8;
    const int stateAuthenticationFailed = 9;
20    const int stateSendProductList = 10;
    const int stateWaitForUserToSelectProduct = 11;
    const int stateSendConfirmationDialog = 12;
    const int stateWaitForUserToConfirmPurchase = 13;
    const int stateProcessTransaction = 14;
25    const int stateTransactionFailed = 15;
    const int stateSendAnotherPurchaseDialog = 16;
    const int stateWaitForUserToExit = 17;
    const int stateSendThankYouMessageBox = 18;
    const int stateExit = -1;
30

    HANDLE hCOMPort;
    DWORD dwReadWriteCounter = 0;
    int iState = stateGetPhoneModel;
35

    // Open COM port for read/write operation.
    logMessage("Connecting to virtual serial port: COM3...");
    hCOMPort = CreateFile("COM3", GENERIC_READ |
40    GENERIC_WRITE, 0, 0, OPEN_EXISTING,
    FILE_FLAG_WRITE_THROUGH, 0);
    if(hCOMPort != INVALID_HANDLE_VALUE)
    {
45        logMessage("Connecting to virtual serial port: COM3 successful.");

        // Set COM timeouts.

```

```

COMMTIMEOUTS timeouts;
GetCommTimeouts(hCOMPort, &timeouts);
timeouts.ReadIntervalTimeout = 20;
timeouts.ReadTotalTimeoutMultiplier = 20;
5   timeouts.ReadTotalTimeoutConstant = 500;
SetCommTimeouts(hCOMPort, &timeouts);

while(iState != stateExit)
10  {
    switch(iState)
    {
        case stateInitializeConnection:
        {
            break;
15        }

        case stateCheckVIPList:
        {
            break;
20        }

        case stateGetPhoneModel:
        {

25      logMessage("BluetoothModuleImplementation::MobileServiceLink(stat
eGetPhoneModel)");

            WriteFile(hCOMPort, phoneThankYouMessage,
strlen(phoneThankYouMessage), &dwReadWriteCounter, NULL);
30      WriteFile(hCOMPort, "\r", strlen("\r"),
&dwReadWriteCounter, NULL);
Sleep(1000);

            ReadFile(hCOMPort, pReadBuffer,
35  READ_BUFFER_SIZE, &dwReadWriteCounter, NULL);
            if(dwReadWriteCounter > 0)
            {
                pReadBuffer[dwReadWriteCounter] = '\x0';
                logMessage(pReadBuffer);
40            }
            else
            {
                logMessage("Nothing received...");
            }
45      iState = stateExit;
            break;

```

```

    }

    case stateGetQpassMemberID:
    {
5       break;
    }

    case stateSendInitialVendorMenu:
    {
10      break;
    }

    case stateWaitForUserToActivateVendorMenu:
    {
15      break;
    }

    case stateSendAuthenticationRequest:
    {
20      break;
    }

    case stateWaitForUserToEnterPassword:
    {
25      break;
    }

    case stateAuthenticate:
    {
30      break;
    }

    case stateAuthenticationFailed:
    {
35      break;
    }

    case stateSendProductList:
    {
40      break;
    }

    case stateWaitForUserToSelectProduct:
    {
45      break;
    }

```



```

        case stateSendConfirmationDialog:
        {
            break;
5       }

        case stateWaitForUserToConfirmPurchase:
        {
            break;
10      }

        case stateProcessTransaction:
        {
            break;
15      }

        case stateTransactionFailed:
        {
            break;
20      }

        case stateSendAnotherPurchaseDialog:
        {
            break;
25      }

        case stateWaitForUserToExit:
        {
            break;
30      }

        case stateSendThankYouMessageBox:
        {
            break;
35      }
    }
}

40     ReadFile(hCOMPort, pReadBuffer, READ_BUFFER_SIZE,
        &dwReadWriteCounter, NULL);

        if(dwReadWriteCounter > 0)
        {
45         pReadBuffer[dwReadWriteCounter] = '\x0';
            if(strstr(pReadBuffer, phoneGetSerialNumber))
            {

```

```

        logMessage(phoneGetSerialNumber);
        WriteFile(hCOMPort, userSerialNumber,
strlen(userSerialNumber), &dwReadWriteCounter, NULL);
    }
5    else if(strstr(pReadBuffer,
phoneGetManufacturerIdentification))
    {
        cout << phoneGetManufacturerIdentification << endl;
        WriteFile(hCOMPort, userManufacturerIdentification,
10    strlen(userManufacturerIdentification), &dwReadWriteCounter, NULL);
    }
    else if(strstr(pReadBuffer, phoneGetModelIdentification))
    {
        cout << phoneGetModelIdentification << endl;
        WriteFile(hCOMPort, userModelIdentification,
15    strlen(userModelIdentification), &dwReadWriteCounter, NULL);
    }
    else if(strstr(pReadBuffer, phoneGetSerialNumber))
    {
        cout << phoneGetSerialNumber << endl;
        WriteFile(hCOMPort, userSerialNumber,
20    strlen(userSerialNumber), &dwReadWriteCounter, NULL);
    }
    else if(strstr(pReadBuffer, phoneMainMenu))
    {
25        cout << phoneMainMenu << endl;
        WriteFile(hCOMPort, userOK, strlen(userOK),
&dwReadWriteCounter, NULL);
    }
30    else if(strstr(pReadBuffer, phoneLoginDialog))
    {
        cout << phoneLoginDialog << endl;
        WriteFile(hCOMPort, userOK, strlen(userOK),
&dwReadWriteCounter, NULL);
35        WriteFile(hCOMPort, userPassword,
strlen(userPassword), &dwReadWriteCounter, NULL);
    }
    else if(strstr(pReadBuffer, phoneAuthenticationMessage))
    {
40        cout << phoneAuthenticationMessage << endl;
        WriteFile(hCOMPort, userOK, strlen(userOK),
&dwReadWriteCounter, NULL);
    }
    else if(strstr(pReadBuffer, phoneProductList))
45    {
        cout << phoneProductList << endl;

```

```

        WriteFile(hCOMPort, userOK, strlen(userOK),
&dwReadWriteCounter, NULL);
        WriteFile(hCOMPort, userProductSelection,
strlen(userProductSelection), &dwReadWriteCounter, NULL);
5      }
        else if(strstr(pReadBuffer, phoneBuyNowDialog))
        {
            cout << phoneBuyNowDialog << endl;
            WriteFile(hCOMPort, userOK, strlen(userOK),
10      &dwReadWriteCounter, NULL);
        }
        else if(strstr(pReadBuffer,
phoneProcessTransactionMessage))
        {
15      cout << phoneProcessTransactionMessage << endl;
            WriteFile(hCOMPort, userOK, strlen(userOK),
&dwReadWriteCounter, NULL);
        }
        else if(strstr(pReadBuffer, phoneBuyAnotherItemDialog))
20      {
            cout << phoneBuyAnotherItemDialog << endl;
            WriteFile(hCOMPort, userOK, strlen(userOK),
&dwReadWriteCounter, NULL);
        }
        else if(strstr(pReadBuffer, phoneThankYouMessage))
25      {
            cout << phoneThankYouMessage << endl;
            WriteFile(hCOMPort, userOK, strlen(userOK),
&dwReadWriteCounter, NULL);
30      }
        else if(strstr(pReadBuffer, "AT"))
        {
            WriteFile(hCOMPort, userOK, strlen(userOK),
&dwReadWriteCounter, NULL);
35      }
        else if(strstr(pReadBuffer, "x"))
        {
            bExit = true;
        }
40      }
        else
        {
            Sleep(1000);
        }
45      }
        CloseHandle(hCOMPort);

```

```

    }
    else
    {
5      logMessage("Connecting to virtual serial port: COM3 failed!");
    }
  }
*/

```

10

The menu for example might look like the following:

```

    Coke,1.50
15    Classic Coke,1.50
    Diet Coke,1.50
    Crystal Coke,1.50
    Sprite,1.50
    Fanta,1.50
20    Orangina,1.50
    Perrier,2.00
    Ice Tea,2.00
    Mountain Dew,1.50
    Dr. Pepper,1.50

```

25

It will be obvious to those skilled in these arts that this WUMPI logic can be applied to any Bluetooth enabled vendor device such as supermarkets, stores, taxis, parking meters, concert box-office. For example, jumping on a train, and paying for the trip on your telephone bill at the end of the month; paying for a taxi, concert tickets, your parking meter, or playing videos, music or Net games on your Palm Pilot or other PDA between classes, debiting your prepaid account.

30

Mobile devices such as GSM phones or PDAs, micropayment solutions, as they are known today from the Internet, can be ported to the real world using devices such as applicants invention described herein. In addition, a wide range of

value-added services can be delivered directly to the point of sale. The main concepts shown here are the dynamic lookup of services, the extension of user interfaces to a mobile phone and the porting of Internet micropayments to the real world.

- 5           Having described the invention in terms of a preferred embodiment, it will be recognized by those skilled in the art that various types of general purpose computer hardware may be substituted for the configuration described above to achieve an equivalent result. Similarly, it will be appreciated that arithmetic logic circuits are configured to perform each required means in the claims. It will be
- 10   apparent to those skilled in the art that modifications and variations of the preferred embodiment are possible, such as different mobile telephony systems may be used, different communications media such as different wireless communications protocols, as well as different types of mobile devices may be used by users, all of which fall within the true spirit and scope of the invention as
- 15   measured by the following claims.